After-sales Service Instructions

Repair

42
VDT-W-420/103 En
Ed. 1

Mechanical Governors

0 420 021 ..-RSF .. M ..

BOSCH After-sales Service
Automotive
Equipment

A-1

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Automotive Equipment – After-sales Service
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1. Introduction

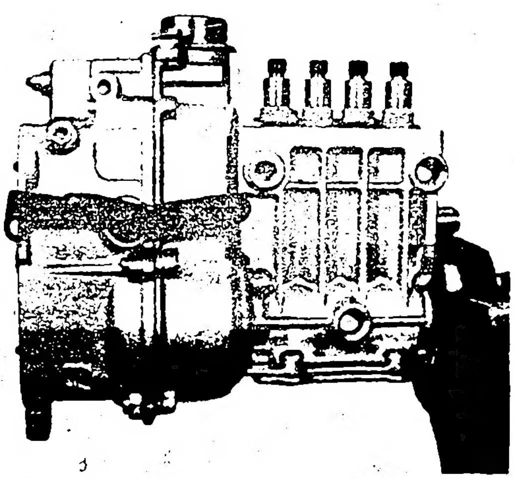
1.1 Construction and Operation

See publication VDT-I-420/1.
Proper repairs require knowledge of this bulletin.

1.2 The item numbers used in the text are listed on page 11.

2. Tools

Designation	Part No.	Utilization
Flange	1 685 720 018	Pilot dia. 68 mm
Clamping support	KDEP 2919	
Support clamp	KDEP 2963	Pump mounting
Coupling half	1 416 430 012	Cone dia. 17 mm
Pin wrench	KDEP 2968	For installation or removal of spring retainer (17)
Pin wrench	KDEP 2998	For removal of flyweight assembly



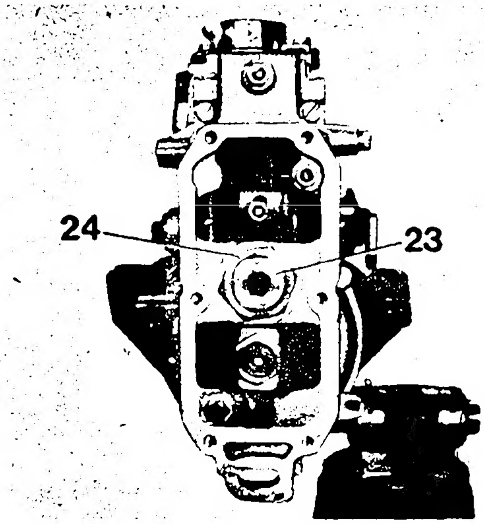
1

3. Disassembly

Mount the pump with governor on clamping support KDEP 2919.

Remove closing cover (84) with gasket (83).

Move the pump with governor downwards and collect the oil that flows out.



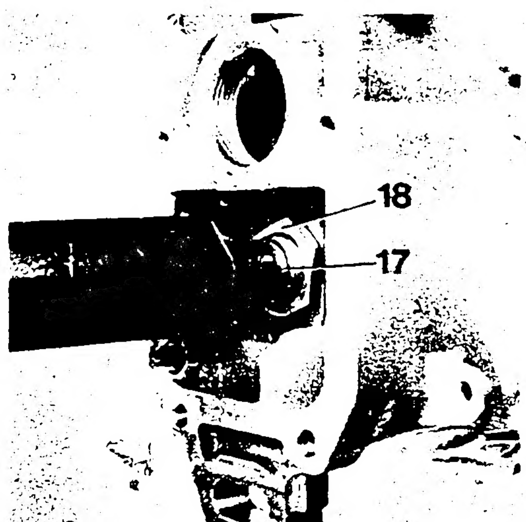
2

Loosen hexagon nut (24).

During the next operation take care of plain washer (20).

Remove threaded sleeve (23).

Remove governor spring (19) and plain washer (20) from the threaded sleeve.



3

Using pin wrench KDEP 2968 loosen hexagon nut (18) and remove spring retainer (17) (Fig. 3).

Loosen but do not remove lock nut (50).

Loosen hexagon nut (31) and screw adjusting screw (29) into the governor housing until leaf spring (idle-speed spring) (34) is released.

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4

Remove fillister-head screws (79, 80).

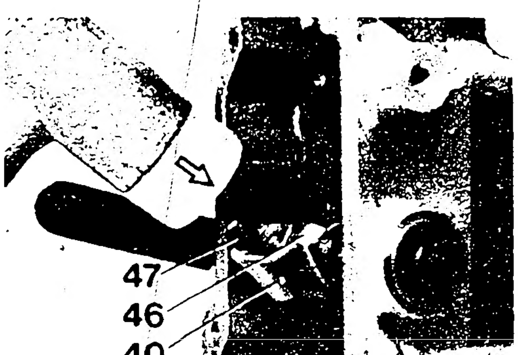
Withdraw governor cover (1).

Remove the clamping spring from the terminal stud of the fulcrum lever. Pull the fulcrum lever from the control rod (Fig. 4).

Remove the governor cover from the pump housing and clamp in a vise. (Use jaw covers.)

Bend open tab washer (51).

Loosen hexagon nut (33) and remove adjusting screw (52) with hexagon nut and tab washer.



5

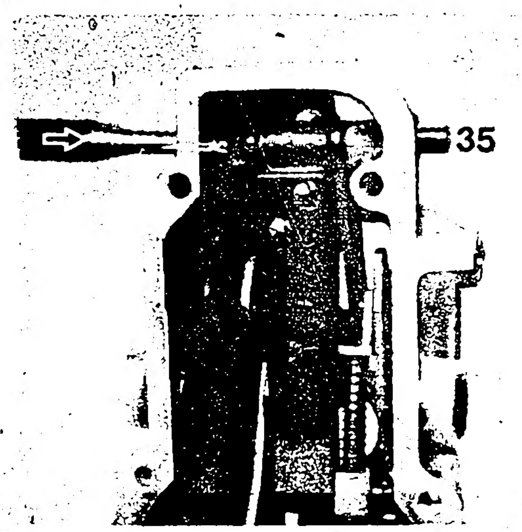
Remove hexagon nut (48) and spring lock washer (86).

Remove clamping screw (47) by tapping lightly on the threaded head using a hammer (use only a plastic hammer) (Fig. 5).

Force off locking washer (45) from the control lever shaft. Remove shim ring (43) and compensating washer (44) from the control lever shaft.

Apply the control lever to the idle stop. To remove the control lever, move it slightly to and fro, removing bracket (46), linkage lever (40) and spacer bushing (41) from the control lever in this order.

Take care of plain washer (38).



6

Force closure cap (36) into the governor housing from one side until the closure cap opposite drops out of the bore.

Force lever shaft (35) back into the governor housing until the second closure cap also drops out of the bore.

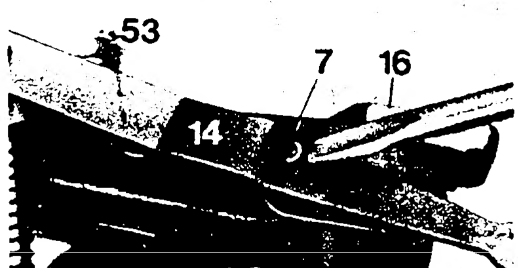
During the next operation take care of the compensating washers between the tensioning and guide levers.

Remove lever shaft (35) from the housing bore.

Remove hexagon nut (31) from adjusting screw (29). Fully unscrew adjusting screw (29) from the tapped hole into the interior of the housing.

Remove the complete lever assembly from the governor housing.

Remove hexagon nut (33) from the idle stop screw. Unscrew adjusting screw (28). Remove hexagon nut (33) from the full-load stop. Remove guide pin (25) from the governor housing with helical compression spring (27) and drive hub (26).



7

Remove retaining clip (7) (Fig. 7). Remove fulcrum lever (14).

Force off one of retaining clips (7) from bearing pin (5). Take care of compensating washers (6) during the next operations.

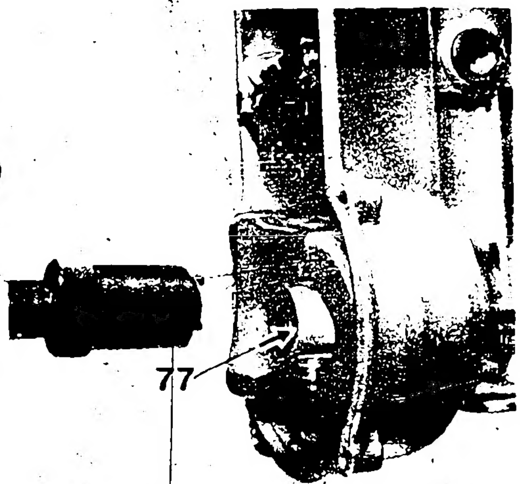
Remove bearing pin (5) from reverse transfer lever (3) and guide lever (2).

Remove compensating washers (6) and sliding sleeve (10) with swivel head (4).

Force off retainer (53) from the "driving pin" of the idle-speed auxiliary spring.

Unscrew lock nut (50).
Remove friction washer (49).
Remove tensioning lever (16) from guide lever (2).
Force off retainer (13) in sliding sleeve.

Remove sliding sleeve (10), needleroller bearing (9) and supporting plate (8) from swivel head (4).



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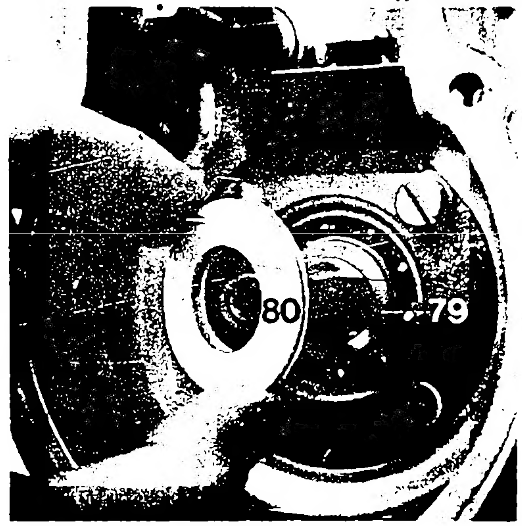


9

Unscrew round nut (77) using KDEP 2998 (Fig. 8).
Remove spring lock washer (76), flyweight assembly (75) and spacer sleeve (73) from the camshaft.
Remove Woodruff key (74).

Remove disc springs (parts of the fuel-injection pump) and compensating washers from the camshaft.

Unscrew fillister-head screws (66). Remove holding bracket (67) and shutoff device (64).

If necessary, unscrew hexagon nut (63). Force out fillister-head screw (59). Remove clamping lever (58) from stop lever (54). Remove locking washer (57) and compensating washer (56) from the stop lever. Pull the stop lever out of the bearing bore in the direction of the governor interior.
Remove O-ring (55).

3.1 Checking of component parts for wear

Clean all component parts.
Check governor parts for wear, replacing damaged components.

New seals and radial-lip-type oil seals should always be fitted whenever repairs are carried out.
During assembly, check governor parts for freedom of movement.

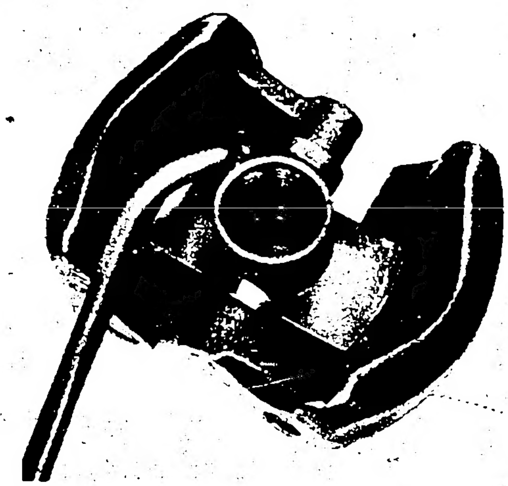
4. Assembly

The cone (governor end) of the camshaft must be free of grease before the flyweight assembly is installed.

Slip retaining washer (79) (part of the fuel-injection pump) over the camshaft.

Slide disc springs (80) (parts of the fuel-injection pump) onto the camshaft, with the curved surfaces facing one another (Fig. 9).

Insert Woodruff key (74) into the groove of the camshaft.
Slip spacer sleeve (73) over the camshaft.

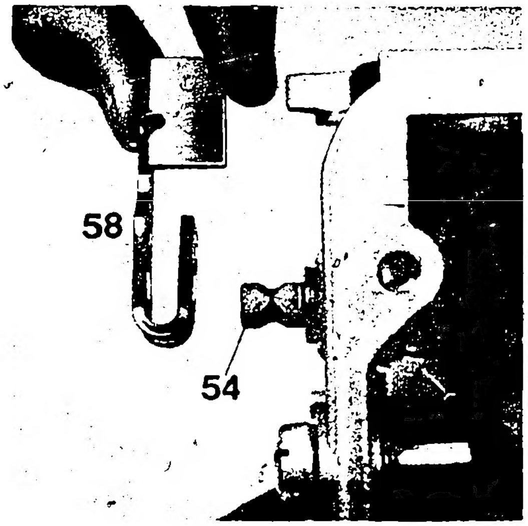


10

Oil the bearing pins of the flyweights on both sides. Check the flyweights for freedom of movement.

Mount flyweight assembly (75), spring lock washer (76) and round nut (77) on the camshaft in this order.

Tighten round nut (77) using KDEP 2998, applying a torque of 50...60 Nm (5.0...6.0 kgfm).



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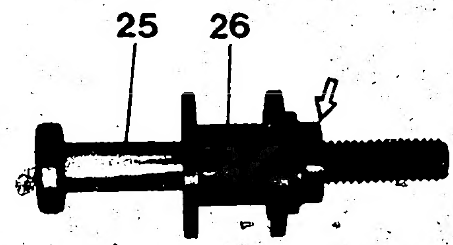


12

Insert stop lever (54) into the bearing bore from the interior of the pump housing.

Attach O-ring (55).
Fit compensating washer (56) and locking washer (57).

Attach clamping lever (58) to stop lever (54), the strap of the clamping lever facing the pump housing (Fig. 11).

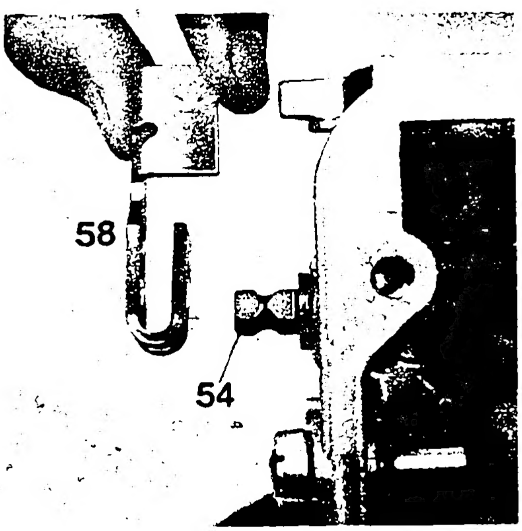
Insert fillister-head screw (59) into the clamping lever.
Install plain washer (60) on the fillister-head screw.
Screw in hexagon nut (63) and tighten, applying a torque of 3 ... 4 Nm (0.3 ... 0.4 kgfm).

Fit a new O-ring (65) to shutoff device (64). Insert the shutoff device into the pump housing, suspending the pin of the shutoff device linkage in the oblong hole of stop lever (54). Mount holding bracket (67) using fillister-head screws (66). Tighten fillister-head screws (66), applying a torque of 5 ... 7 Nm (0.5 ... 0.7 kgfm).

Slip drive hub (26) over guide pin (25), the shoulder facing the thread of the guide pin (Fig. 12). Place helical compression spring (27) over the guide pin and up against the drive hub.

Screw the complete guide pin into the governor cover.

Screw on hexagon nut (33) and tighten by hand.



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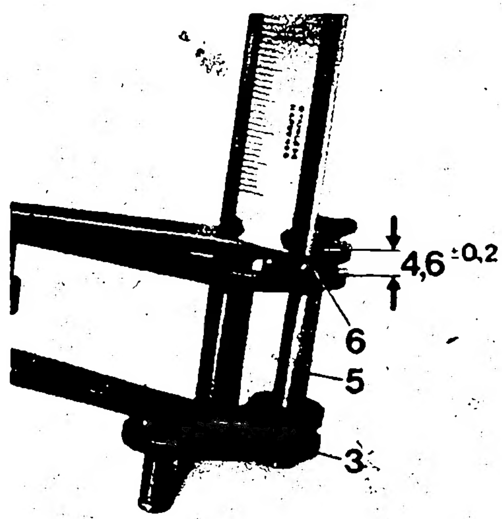


13

Move stop lever (54) to and fro several times, checking the stop lever and shutoff device for freedom of movement.

Press new radial-lip-type oil seals (39) into the governor cover. Wet adjusting screw (29) with machine oil and screw into the governor cover.

Screw adjusting screw (28) into the governor cover.
Screw on hexagon nut (33) and tighten by hand.

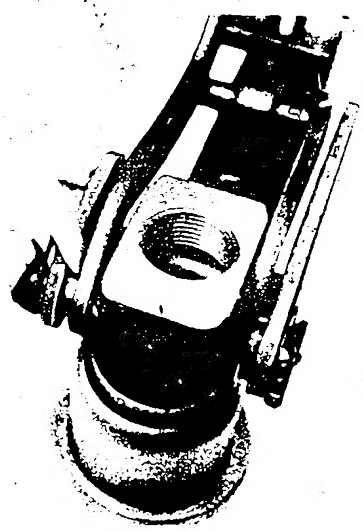
Measuring of compensating washers (6):

Insert bearing pin (5) into the bearing bore of reverse-transfer lever (3) (on the side of the long leg of the lever).

Push bearing pin (5) through shims (6) and guide lever.

The spacing between the outer faces of the reverse-transfer lever and guide lever must be 4.6 ± 0.2 mm (Fig. 13). Adjust by means of shims (6).

Mount supporting plate (8), needle-roller bearing (9) and sliding sleeve (10) on swivel head (4) in this order. Fit retainer (13).



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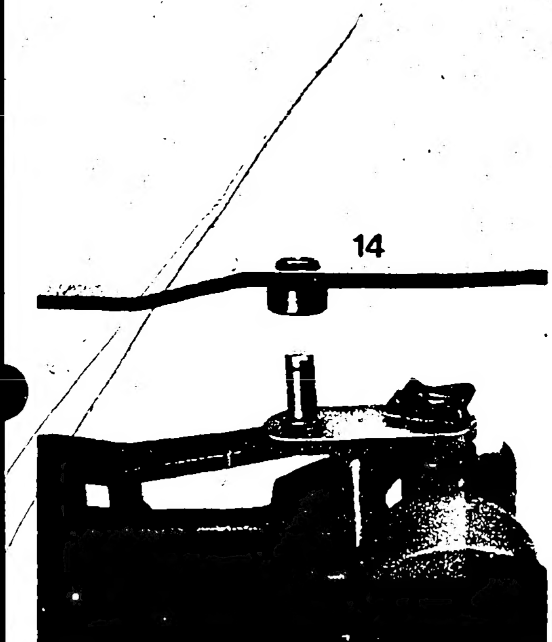
Fully insert bearing pin (5) into swivel head (4) (with sliding sleeve), guide lever, shims and reverse-transfer lever.

Determine the axial clearance of the reverse-transfer lever using a feeler gauge (clearance = 0.1 ± 0.2 mm) (Fig. 14).

Adjust by means of shims (6) on the side of the short leg of the reverse-transfer lever.

Secure bearing pin (5) with retaining clips (7).



15

During the next operation the bushing of the fulcrum lever must face the reverse-transfer lever.

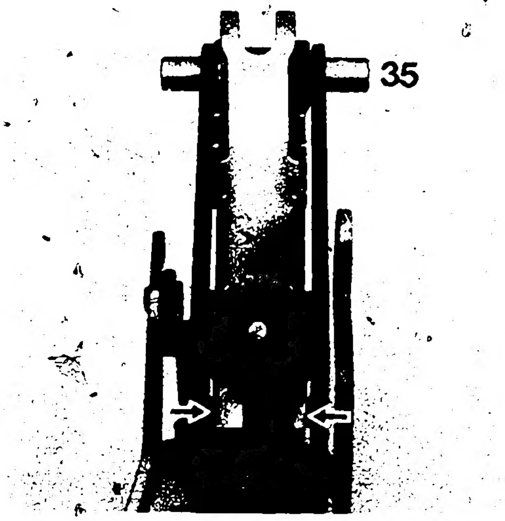
Guide fulcrum lever (14) onto the bearing pin of the reverse-transfer lever and secure with retaining clip (7) (Fig. 15).

Insert lever shaft (35) into the guide lever and tensioning lever (16).

Adjust the axial clearance to 0.1 $^{+0.2}$ mm between the guide lever and tensioning lever by means of shims (42). As far as possible, fit the same number of shims on both sides.

Screw spring retainer (17) into the tensioning lever.

Ensure that the spacing between the annular surface of the spring retainer with milled-in groove and the seating surface of the hexagon nuts at the tensioning lever is 7 mm.



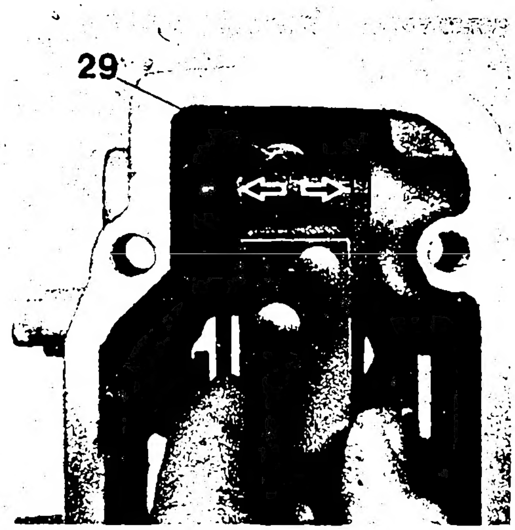
16

Suspend leaf spring (34) in tensioning lever (16). The long fork end of the leaf spring must be in front of the transverse pin of the guide lever (Fig. 16).

Remove lever shaft (35) from the guide and tensioning levers.

To facilitate installation of the lever assembly in governor cover (1), a user-manufactured pin (7.7 mm dia., 27.8 mm long) can be inserted into the guide lever, shims and tensioning lever during the next operations.

When installing lever shaft (35), the user-manufactured pin is pushed out through the bearing bore of the governor cover.



17

Screw adjusting screw (29) into the governor cover until it is flush with the outer housing edge of the governor cover.

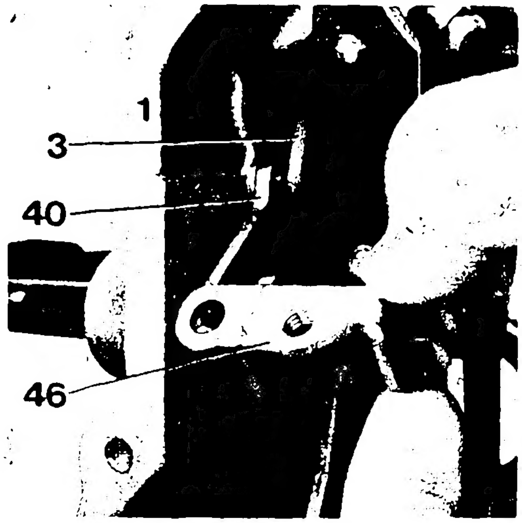
Insert the complete lever assembly into the governor cover. Suspend the short fork end of leaf spring (34) behind the head of adjusting screw (29).

Insert tensioning lever (16) so that it contacts the rivet-headed pin. Unscrew adjusting screw (29) further. Insert lever shaft (35) into the bearing bore of the governor cover and through the lever assembly.

Attach hexagon nut (31) and tighten by hand.

Press the guide lever first to one side of the governor-cover housing and then to the other. The tensioning lever must move easily in both positions (Fig. 17).

Fit a new closure cap (36).



18

Insert control lever (37) into the bearing bore of governor cover (1).

During the next operation suspend linkage lever (40) in the oblong hole of reverse-transfer lever (3).

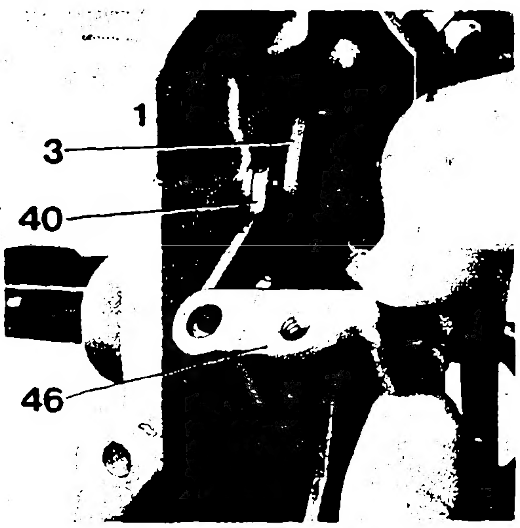
Slip spacer bushing (41), linkage lever (40) and bracket (46) over the control lever in this order (Fig. 18).

Insert the control lever into the second bearing bore.

Mount shims (44), shim ring (43) and locking washer (45).
The control lever must have no axial clearance but be free to move.

Adjust by means of shims (44).

Insert clamping screw (47) into linkage lever (40) and bracket, the thread facing upwards.



18

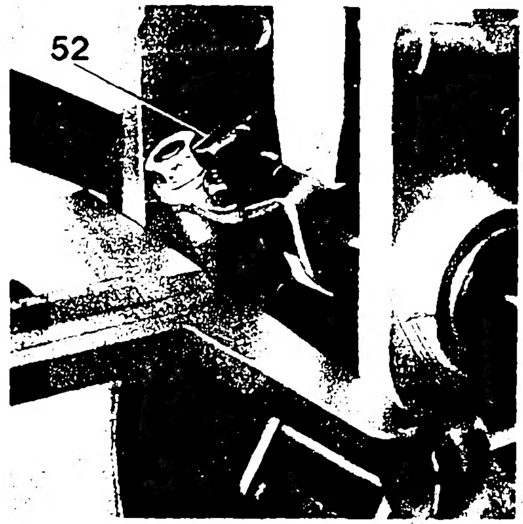
Mount spring lock washer (86) and hexagon nut (48).
Tighten hexagon nut (48), applying a torque of 6.0 ... 7.0 Nm (0.6 ... 0.7 kgfm).

Screw threaded sleeve (23) with plain washer (20) and governor spring (19) into governor cover (1). Pre-load the governor spring slightly.

Screw on hexagon nut (24) and tighten manually.

Place the control lever shaft in the idle and full-load positions.

The idle-speed auxiliary spring must not contact the control-lever shaft in either positon.



19

Screw in adjusting screw (52) with tab washer (51) and hexagon nut (33).

Screw in adjusting screw (52) until the idle-speed auxiliary spring is compressed by 2.8 ... 3.2 mm in the full-load position of the control lever.

Measure at the end of the spring using a depth micrometer (Fig. 19).

Tighten hexagon nut (33), applying a torque of 5 ... 7 Nm (0.5 ... 0.7 kgfm).

Lock adjusting screw (52) by means of tab washer (51).

During the next operation ensure that the Teflon-coated side of friction washer (49) faces the guide lever.

Mount friction washer (49), lock nut (50) and retainer (53) on the threaded pin of the idle-speed auxiliary spring.

Apply the sleeve with swivel head to the torque-control capsule.

The idle-speed auxiliary spring and idle-speed spring must not be stressed.

Check whether the full width of the swivel head is in contact with the torque-control capsule.

If necessary, replace the lever assembly.

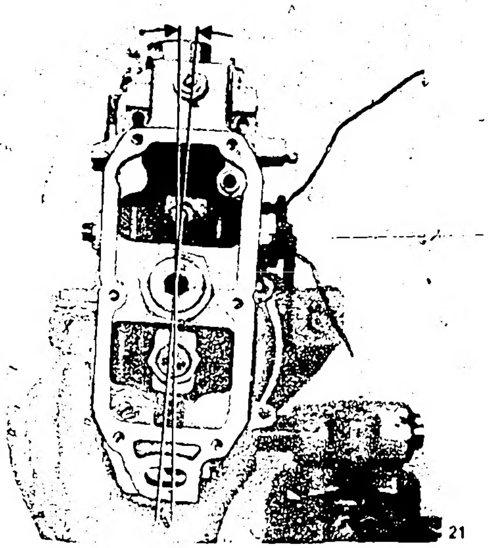
20

Fit new gasket (78) on governor cover.

Place the lower edge of the governor cover on the pump housing.

Insert the sliding sleeve into the flyweight assembly.

Suspend fulcrum lever (14) in the control rod (Fig. 20).



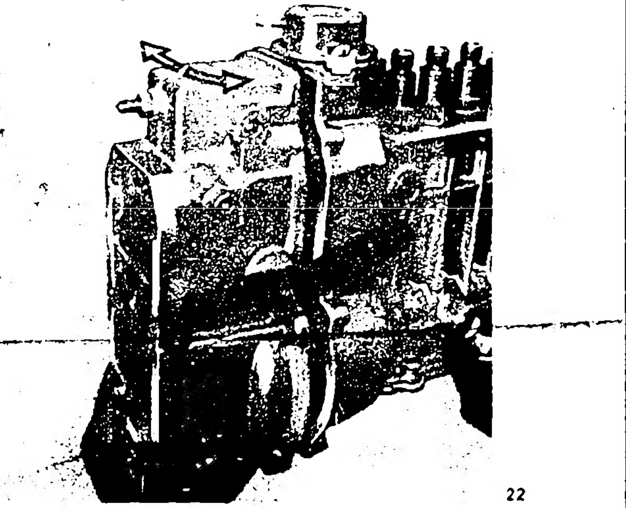
21

Checking governor linkage for freedom of movement.

Move the governor cover to the left and right.

The angle of deflection in both directions must be approximately equal (Fig. 21).

If the governor cover cannot be moved, the governor linkage must be checked and replaced if necessary.



22

Move the governor cover about the longitudinal axis (horizontal line) of the fuel-injection pump (Fig. 22).

The angle of deflection on both sides must be approximately equal.

If the governor cover cannot be moved, the governor linkage must be checked.

Place the governor cover on the pump housing.

Fit fillister-head screws (79 and 80) and tighten, applying a torque of 5.0...7.0 Nm (0.5...0.7 kgfm).

5. Tightening torques

Item No.	Designation	Nm	kgfm
18	Hexagon nut	30 ... 35	3.0 ... 3.5
24	Hexagon nut	60 ... 80	6.0 ... 8.0
31	Hexagon nut	17 ... 24	1.7 ... 2.4
33	Hexagon nut	7 ... 9	0.7 ... 0.9
48	Hexagon nut	6 ... 7	0.6 ... 0.7
63	Hexagon nut	3 ... 4	0.3 ... 0.4
66	Fillister-head screw	5 ... 7	0.5 ... 0.7
77	Round nut	50 ... 60	5.0 ... 6.0
79	Fillister-head screw	5 ... 7	0.5 ... 0.7
80	Fillister-head screw	5 ... 7	0.5 ... 0.7
85	Fillister-head screw	5 ... 7	0.5 ... 0.7

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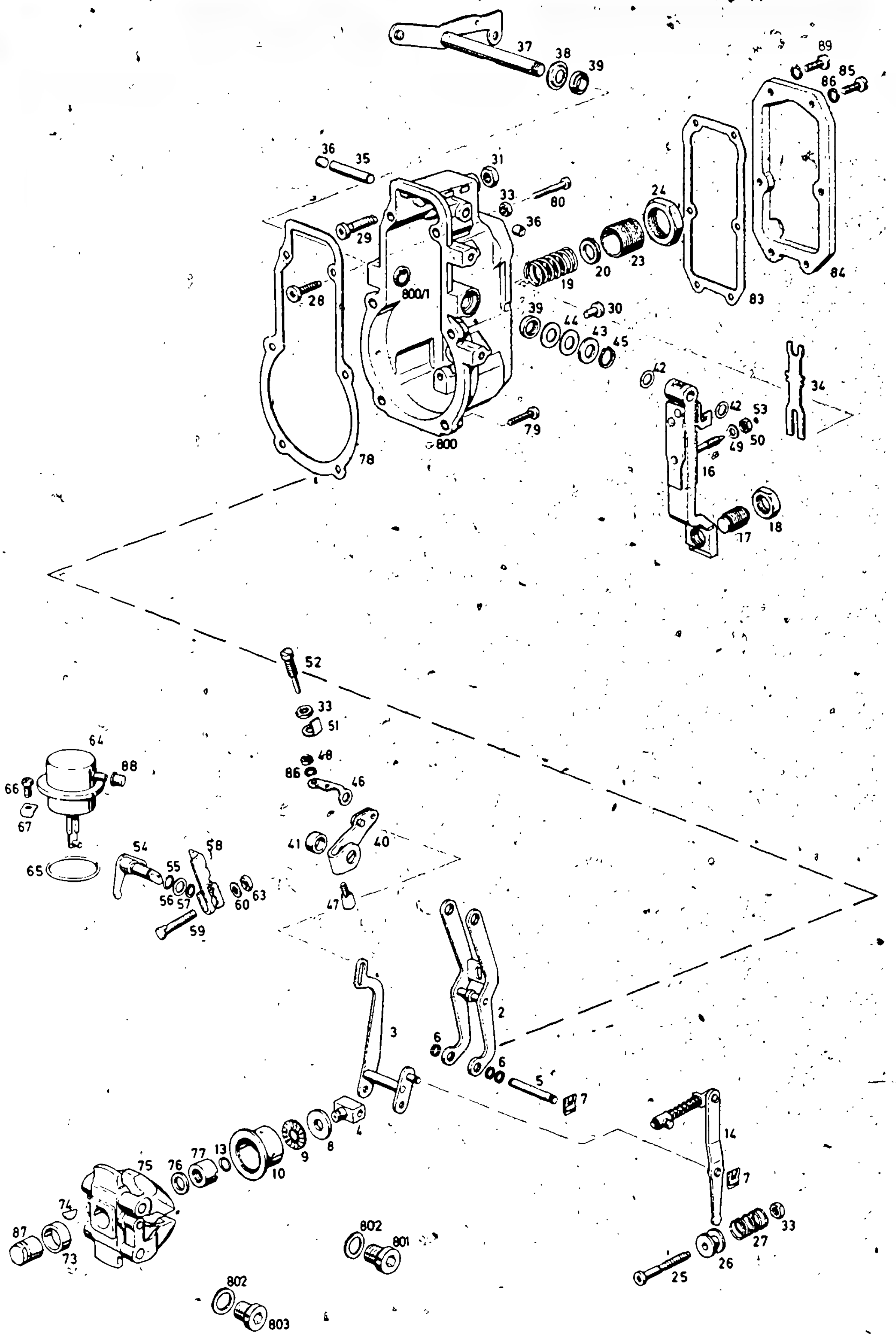

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11.1983

NEW PRODUCT

RSV GOVERNOR WITH ADJUSTABLE SLEEVE POSITION AND ADJUSTABLE TORQUE CONTROL CAPSULE

To facilitate adjustment and to improve the accuracy of adjustment, the RSV governors of all pump sizes have been produced since April 1983 for various original-equipment manufacturers with an adjusting screw for the sleeve position and an adjustable torque-control capsule.

This design innovation calls for the change-over of the governor version to the next change letter:

RSV.. M.. C.., RSV.. MW.. A.., RSV.. A.. C.., RSV.. P.. A..

Construction

1. Adjustable sleeve position:

An additional adjusting screw is installed in the governor cover next to the full-load-delivery adjusting screw. The shape and configuration of this screw differ depending on the type of governor:

RSV governors without stop lever are provided with a specially shaped screw (1) to support the new downward-extended fulcrum lever (2). Governors with stop lever are provided with a special hexagon screw (3) for adjusting the sleeve position from outside. These screws are locked so that they cannot turn by means of a slotted round nut (4).

This adjusting of the sleeve position from outside makes it possible to dispense with the previously used shims on the plain bearing of the sliding sleeve. The previous plain bearing is replaced by a low-friction needle-roller bearing. This results in a reduced torque on the guide lever and thus in reduced wear on the flyweight sliders.

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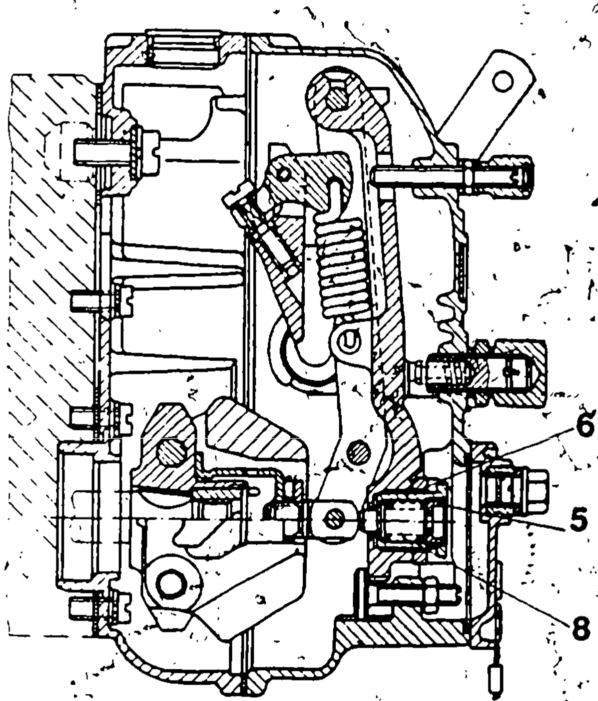
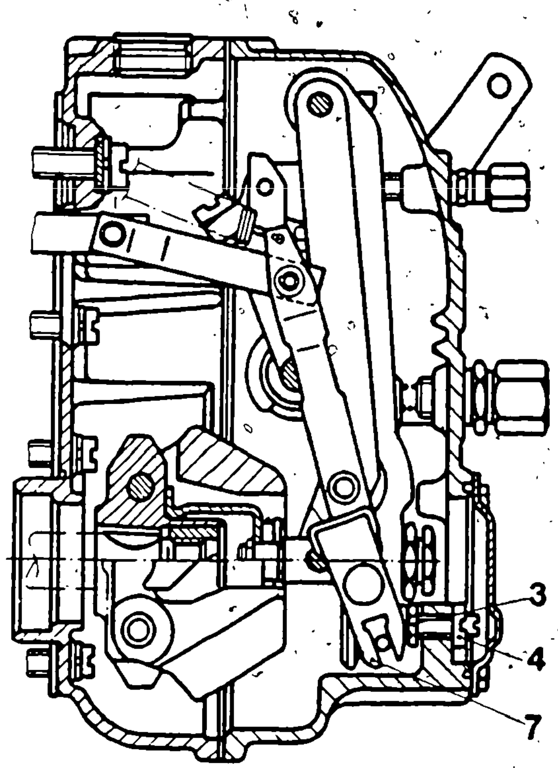
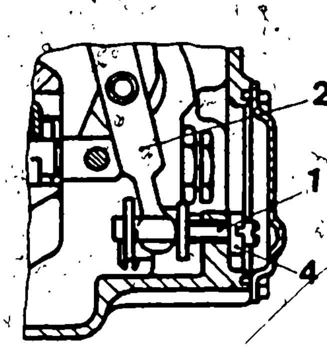
2. Adjustable torque-control capsule:

An additional self-locking adjusting screw (5) is screwed into the spring capsule housing (6) for adjusting and changing the preload of the torque-control spring (8). The adjusting screw is oval in form to make it self-locking. It may only be used once.





WITH STOP LEVER



WITHOUT LEVER

Operation

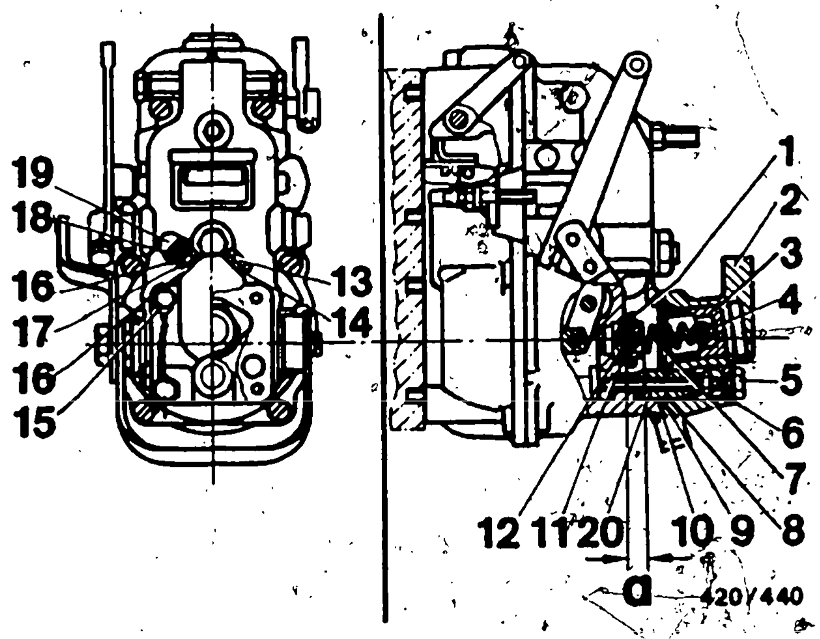
Turning the adjusting screw (1) changes the position of the lower pivot point of the fulcrum lever. With the control lever released, the flyweights achieve their maximum deflection at the specified speed. The sliding sleeve is thus moved in the direction of the governor cover. Shifting the lower pivot point of the fulcrum lever changes the position of the control rod in the shutoff position. In governors with a stop lever the adjusting screw does not act directly on the fulcrum lever, but on the inner stop lever (7). The sleeve position is adjusted with the pump operating. This dispenses with the previous need to remove the governor cover to adjust the sleeve position. The parts of the new RSV governor differ in some cases considerably from those of the previous version. Therefore, the parts are not interchangeable.

Notes on adjustment and testing are given in a separate Technical Bulletin.

Register 40...46, 58
File Identity VDT-I-420/120 En
11.1986

RSV GOVERNOR

Instructions for assembly and testing the stabilizer



1 = Lock nut
2 = Stabilizer housing
3 = Stabilizer piston
4 = Bolt
5 = Screw plug
6 = Seal ring
7 = Stabilizer spring
8 = O-ring
9 = Gasket
10 = Partioning plate
11 = Threaded bushing
12 = Bolt
13 = Screw plug
14 = Seal ring
15 = Fastening screw
16 = Seal ring
17 = Lock nut
18 = Throttle screw
19 = Cap nut
20 = Guide bushing
a = Extension

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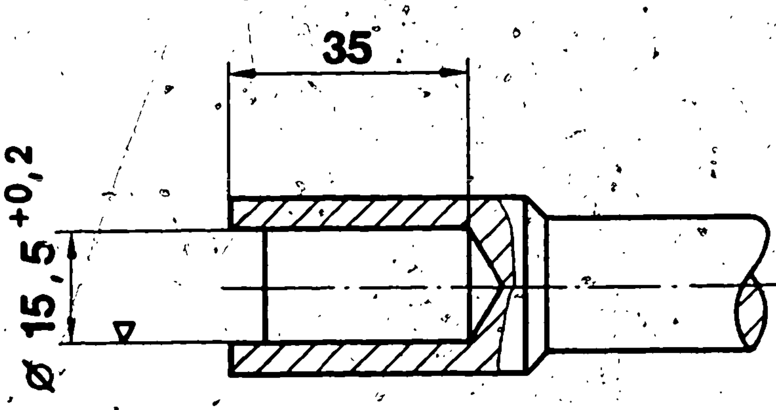

420/441

Assembly
Requirement:
Complete fuel-injection pump assembly without built-on stabilizer is clamped on to the fuel-injection pump test bench and the sleeve position of the governor is set (microcard SIS-W-420/310, coordinate C4).

Put the threaded bushing (Item 11), bolt (Item 12), spring (Item 7) and lock nut (Item 1) together to form an assembly and screw into the threaded bore in the governor tensioning lever, in which the torque-control spring retainer usually sits. Make sure that the lugs of the stabilizer spring are precisely aligned along the longitudinal axis of the tensioning lever. The extension "a" of the screwed-in threaded bushing is 7.0...8.0 mm. For screwing in and tightening the whole assembly, use socket wrench KDEP 2966 with modification (see illustration) and tighten lock nut to 30...35 Nm.

After testing the spring attachment for freedom of movement, apply a thin coating of lubricating oil to the stabilizer piston (Item 3) and lock into spring lugs with bolt (Item 4) (spring lug must latch into bolt groove). Check stabilizer piston for freedom of movement and level position.

Lie the partitioning plate (Item 10) and gasket (Item 9) onto the sealing surface of the governor cover.

Thinly apply oil-tallow mixture 5 963 340 110 to O-ring (Item 8) and pull onto guide bearing (Item 20).

Fit stabilizer housing (Item 2) and tighten onto governor housing with fastening screws (Item 15). Specified tightening torque = 6...8 Nm.

<u>Testing</u>

After removing the cap nut (Item 19), open the throttle screw (Item 18) by approx. 4...5 rotations. Remove screw plug (Item 13). Screw the tailpiece of the test hose KDEP 1618 into the threaded bore. The hose must be laid vertically.

Fill up the governor with lubricating oil until the oil level is visible at the transparent test hose KDEP 1618.

Set the control lever to maximum deflection and fix in this position.

Switch on the test bench and drive the fuel-injection pump assembly at the specified speed for setting the full-load delivery.

Increase speed until the governor has completed regulation and reduce speed again down to initial speed. Repeat this procedure (increasing and decreasing the speed) four to five times.

On increasing the speed, the oil level in the test hose KDEP 1618 must rise each time and drop correspondingly on decreasing the speed.
If this is not the case, check whether the stabilizer piston (Item 3) has freedom of movement or whether the setting of the throttle screw (Item 18) is correct and, if necessary, put these right.

After successfully testing the operation of the stabilizer, shut down the test bench. Close the throttle screw as far as it will go and tighten the lock nut (Item 17). Position the seal ring (Item 16) and tighten the cap nut (Item 19).

Unscrew the test hose KDEP 1618 from the stabilizer housing and screw the screw plug with seal ring (Items 13 and 14) into the stabilizer housing and tighten.

Continue governor adjustment in accordance with the test instructions SIS-W-420/310.

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40...46, 58

TESTING THE COLD-STARTING DEVICE IN RSV..P..GOVERNORS

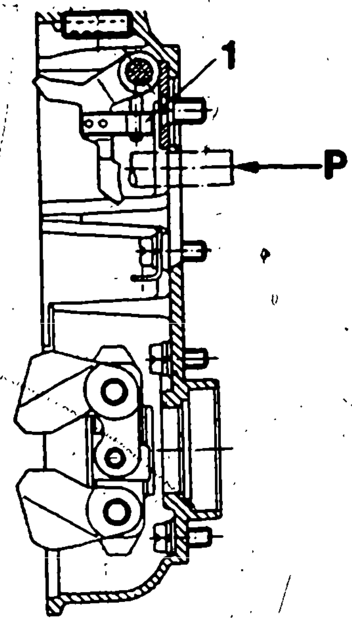
VDT-I-420/114 En
8. 1984
supersedes 3. 1984

Some RSV governors, size P, are equipped with special cold-starting devices which are intended to provide reliable starting of the engine.
Injection-pump assemblies with these governors are tested as follows:

1. At cranking speed 100 min^{-1} set the stop screw of the start lever to 20.00...20.5 mm control-rod travel.

2. Test the unlatching force of the cold-starting device at standstill with a spring balance on the control rod.
   p = 14...22 N (1.4...2.2 kgf)
   If necessary, retension leaf spring (1). The riveting must not work loose.
   Perform governor testing and full-load setting as usual.

Bu A19



1 = Leaf spring (for setting the unlatching force of the cold-starting device)

3. The switch from starting control-rod travel to full-load control-rod travel must take place at 650... 850 min^{-1}, i.e. in this engine-speed range the latch must release.

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Register 40...46, 58
File Identity VDT-I-420/119 En
9.1986

CHANGE OF SWIVELLING-LEVER ADJUSTMENT SCREW IN RS(U)V.. GOVERNORS

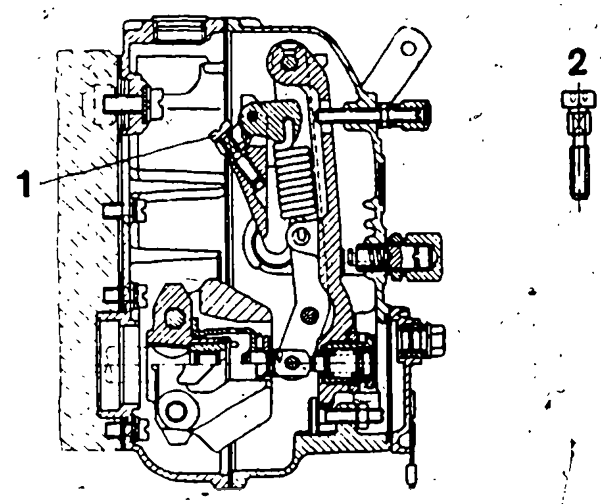

Figure 1 1 = Previous version with slot
2 = New version with Allen head

The adjustment screw, shown in Figure 1, of the swivelling lever in RS(U)V.. governors was previously a slotted- head screw.

The slotted-head screw has as of now been replaced by an Allen-head screw.

Key size is 4 mm.

A ball-head screwdriver (e.g. HAZET no. 827-04) is to be used to turn the screw when setting the governor.

The old and new versions of the adjusting screw are freely interchangeable.

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EP/RSV.. 0 42. . .
EP/RSUV.. 0 42. . .

1. Introduction

1.1 General

EP/RSV governors are centrifugal variable-speed governors which unlike to RQV governors, permit easy and rapid adjustment of governing range and speed drop.

The EP/RSUV governor was developed for governing at extremely low speeds, and incorporates a step-up gear transmission between injection pump camshaft and governor shaft. Here a pair of gears produces a speed increase of – depending on application – 1:1.86, 1:2.15, 1:2.75, 1:3.29 or 1:4 (further transmission ratios available for special requirements).

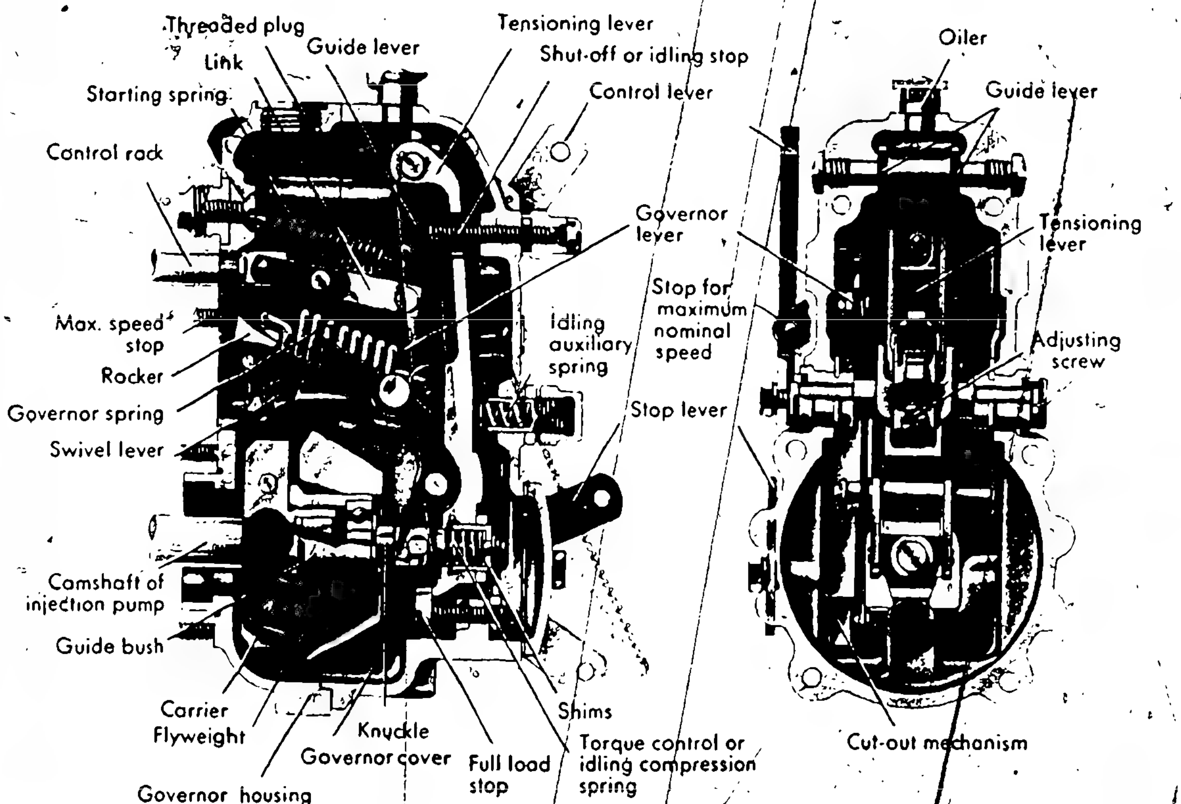

Fig. 1 EP/RSV governor

The function of these governors is described in publication VDT-UBP 211/11. Prior to carrying out repairs on governors in accordance with these instructions, it is advisable to read the above publication.

General build-up of these governors is shown in Figs. 1 and 2.

Absolute cleanliness is essential when repairing governors.

A23

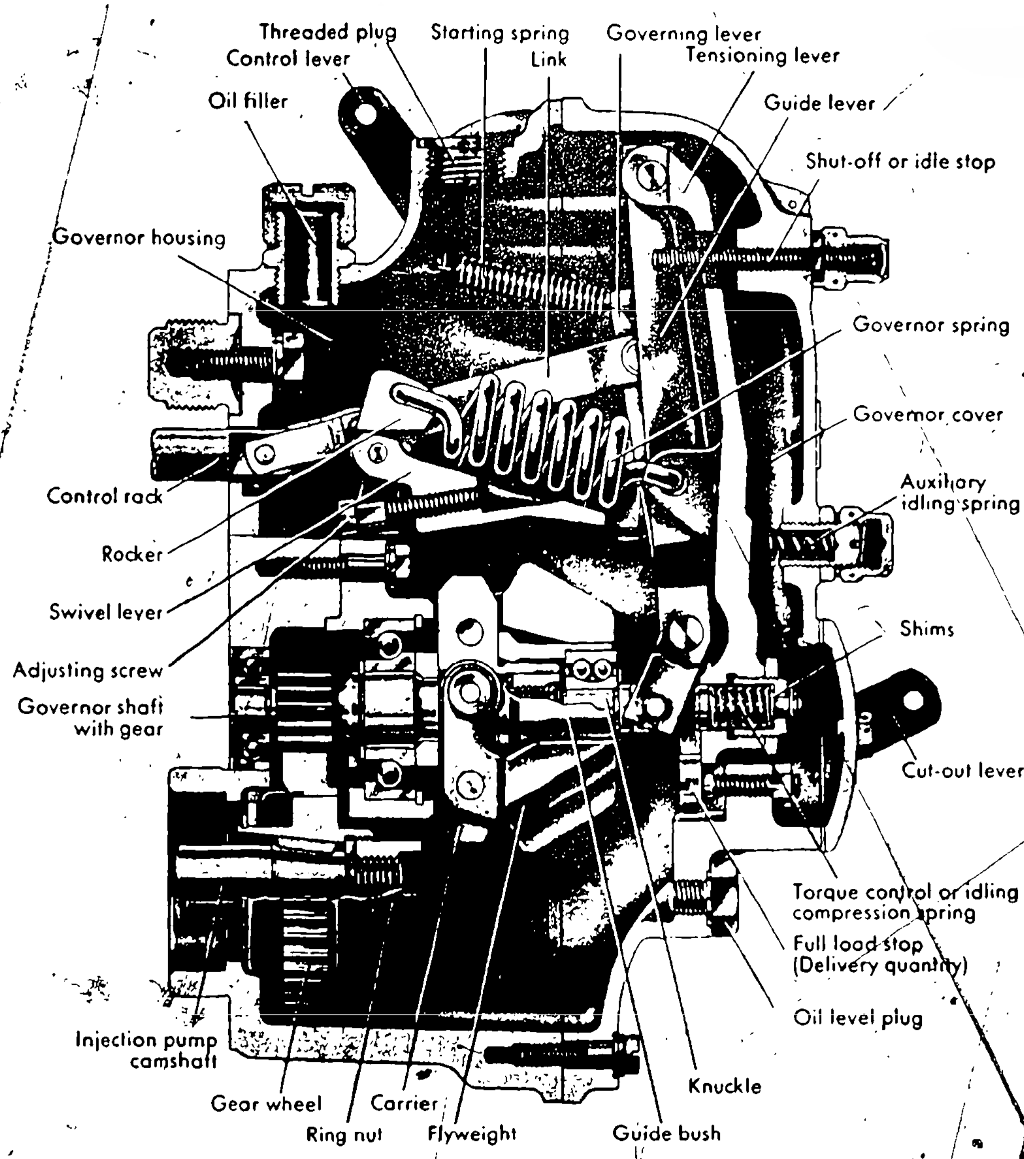

Fig. 2 EP/RSUV Governor

1.2. Fitting or modification

The governor is fitted to that side of the pump which is indicated by the assembly number.

The function of these governors is such that in operation, they exert an increasing axial force on the camshaft which force then has to be sustained by an opposing force from the injection pump bearing or by the governor shaft bearing (on EP/RSUV governors). On governors with step-up gearing, appropriate bearings are fitted into the governor. However, on standard EP/RSV governors this force (max. approx. 30 kg) must be sustained by the bearing on the drive side of the injection pump.

On pumps supplied complete with EP/RSV governors, appropriate bearings are fitted on manufacture. However, if a pump initially fitted with an RQV governor or supplied without governor is to be subsequently equipped with a EP/RSV governor, observe the following:

A deep-groove radial type ball bearing has to be fitted to the injection pump drive side in lieu of the shoulder contact ball bearing. To ensure perfect assembly, the outer race is a sliding fit in the bearing cover. This demands a modified bearing cover.

If the above modification is to be carried out the following components have to be ordered in addition.

These are:

Component	For "A" pumps	For "B" pumps
1 Deep-groove radial type ball bearing	NKL 20/17 Z	NKL 20/20 Z
1 Spacer ring	WMR 24 P 19 X	–
1 Bearing cover PE ..	PDE 105 P 11 X	
PES ..	EPDE 20 P 11 Z	
4 Screws	NSR 5265/22 X	NSR 5265/22 X
4 Circlips	NMS 440/5 X	NMS 440/5 X

On pumps with a special bolted-on flange, the designations for the bearing cover can be taken from the Spare Parts Lists. A further factor requiring attention in the case of "B" size pumps when fitting EP/RSV governors to the pump is that a camshaft with a "17" taper on the governor side must be fitted. On reinforced size "A" pumps (pumps with 11 mm wide cams, roller tappets with wide roller and sliding tenon, with bottoming screws) the deep-groove ball bearing is replaced by a taper roller bearing NKL 51/17 Z with spacer ring WMR 16 S 3 X. This bearing is a push fit into its housing and therefore requires different bearing covers, e.g.

on PE . . . "A" pumps PDE 105 P 14 X
PES . . . "A" pumps EPDE 20 P 16 X.

However, subsequent fitting of EP/RSV governors to reinforced pumps rarely arises on reinforced pumps since these pumps are supplied, ex. works, equipped with these governors.

1.3. Operation sequence and part numbering

The following comments are given in relation to the operating sequence and part numbering:

The introduction of the "A modification" for the governors described involves a number of modified and new components.

For this reason, illustrations and numbering for the "A modifications" should be taken from the newly added illustration sheets applicable to the governor given at the end of the instructions or in the spare parts lists. The dismantling and re-assembly sequences are hardly affected and can thus be applied to "A modifications" as well.

For further details see page 24 covering "A modifications" on EP/RSV .. – .. A 1-9 **A**, EP/RSV .. – .. B 1-9 **A** and EP/RSUV .. – .. B 1-10 **A**.

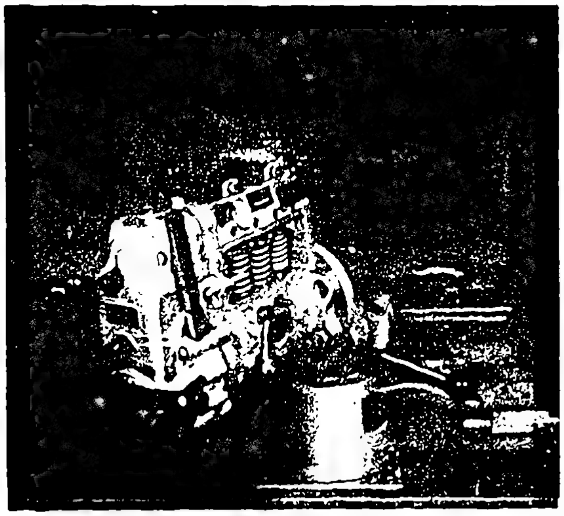

Fig. 3 Pump and governor fitted to vise

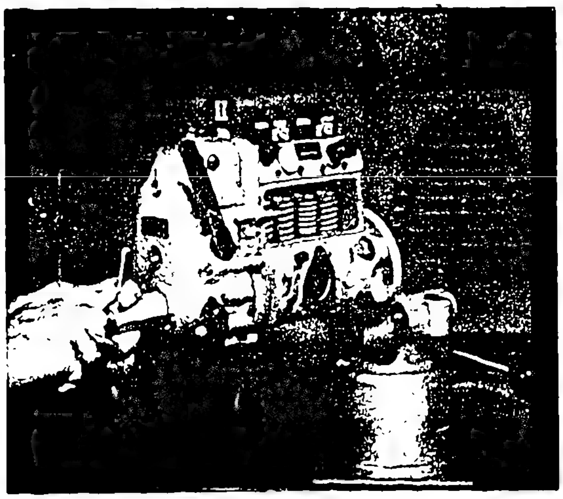

Fig. 4 Unscrewing of spring capsule

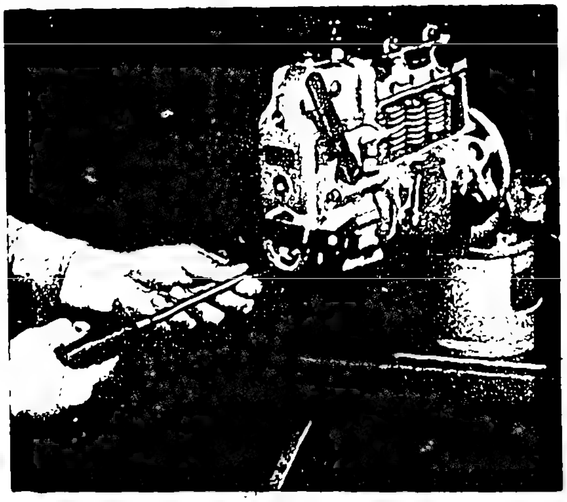

Fig. 5 Unscrewing the governor cover bolts

2. Dismantling

2.1. Initial examination

Prior to dismantling, it is recommended that the governor be examined when still fitted to the injection pump. Investigation of the customer's complaint is also recommended. For this purpose injection pump and governor must be fixed to a test bench for checking.

At the dismantling stage mating components must be inspected for wear. Components worn excessively require replacement since the resultant play would have disadvantageous effects on the control rack because of the high lever ratio.

2.2. Operation sequence on EP/RSV governors

(The bracketted numbers () refer to the appropriate consecutive numbers appearing on the folded-in illustration at the end of this instruction booklet).

2.2. 1. Remove blanking cover and feed pump from injection pump and withdraw dipstick.

Fit injection pump together with its governor to swivelling vise EP 8498 (Fig. 3). On PES . . A pumps, use angle clamping bracket EF 8498/30. Unscrew stop or idling stop screw (87 . . . 89) and auxiliary idling spring (92 . . . 96). Remove hex. bolts (144) complete with spring washers (145) and lift off end-cover (142). Collect oil running out in work bench tray or suitable container.
Carefully release gasket (143).

When applicable, unscrew oil level plug (98) and sealing washer (99) on standard governors.

Unscrew spring capsule (39) from tensioning lever (35) releasing lock nut (40) with spanner EFEP 202 and remove spring capsule (Fig. 4).

2.2. 2. Release bolts (150) securing governor cover (30) (Fig. 5) and remove spring washers (Ateco washers) (152). On certain pumps equipped with standard spring washers (with sharp edge) a plain washer protecting the cover is also used.

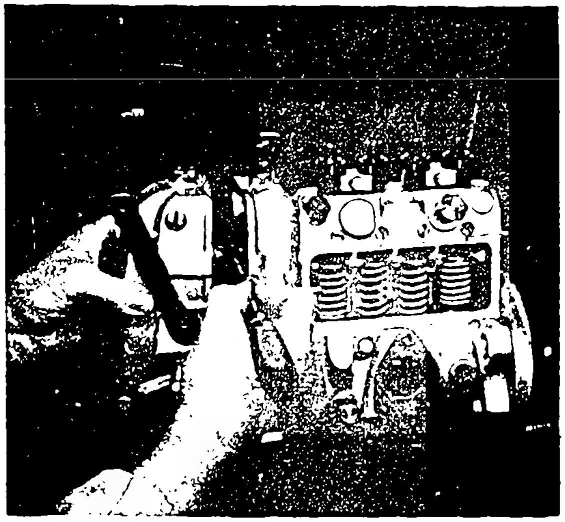

Fig. 6 Removing link from control rack

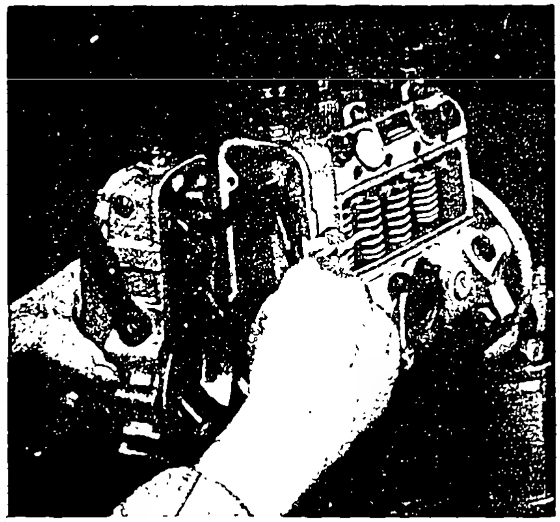

Fig. 7 Unhooking the starting spring

Loosen cover with light blows from a rubber hammer and carefully lift from housing spigot. Collect lube oil running out.

2.2. 3. Release link (48) from control rack by spreading the leaf spring (Fig. 6).

On certain versions this connection is still made by a pin, intermediate washer and split pin. In such instances these components must be removed. Unhook starting spring (86) from eye (21) in governor housing using thin-nosed pliers (Fig. 7).

2.2. 4. Release ring nut (6) on governor flyweight assembly (1) using pin wrench EFEP 187 A securing against rotation with wrench EFEP 119 applied to the coupling at the opposite end of the camshaft end (Fig. 8).

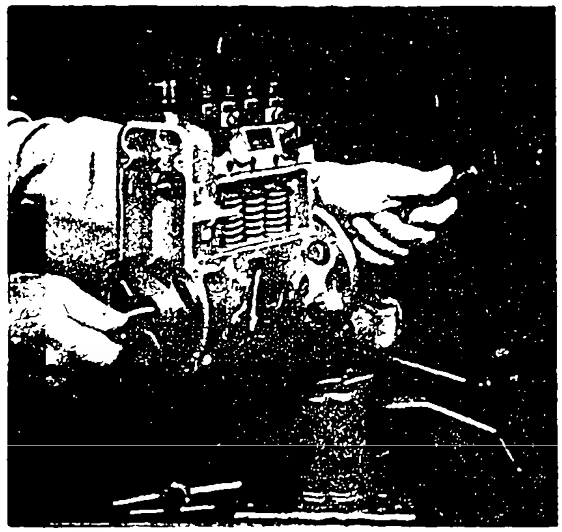

Fig. 8 Unscrewing the ring nut from the governor flyweight assembly

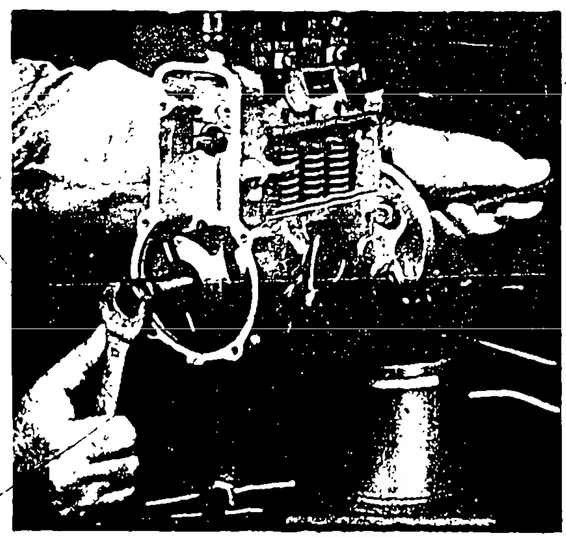

Fig. 9 Extracting the governor flyweight assembly

Remove spring washer (7) and withdraw governor flyweight assembly with extractor EF 8449 or EF 8132 (Fig. 9). Remove Woodruff key (5) from camshaft taper.

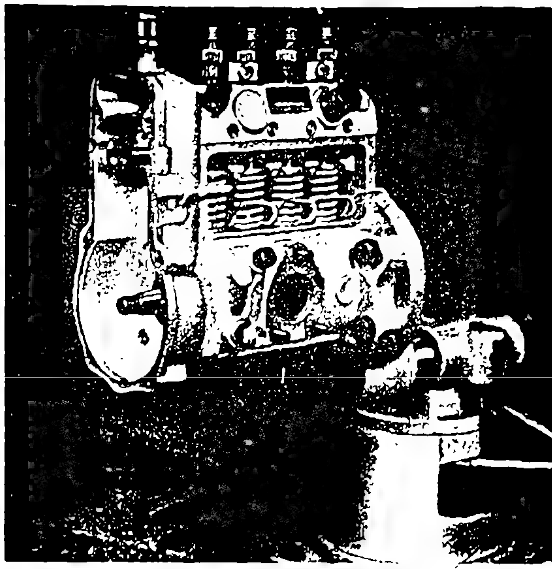

Fig. 10 Lifting the roller tappets

2.2. 5. If governor housing (8) is to be removed, the roller tappets of the injection pump together with tappet holders EFEP 311 (formerly EF 8183) (for pumps of size A), EFEP 312 (formerly EF 8034 A) (for size B) or EFEP 205 (for "high-speed" pumps of Size A) (Fig. 10) must first be lifted clear of the camshaft so as to relief the latter.

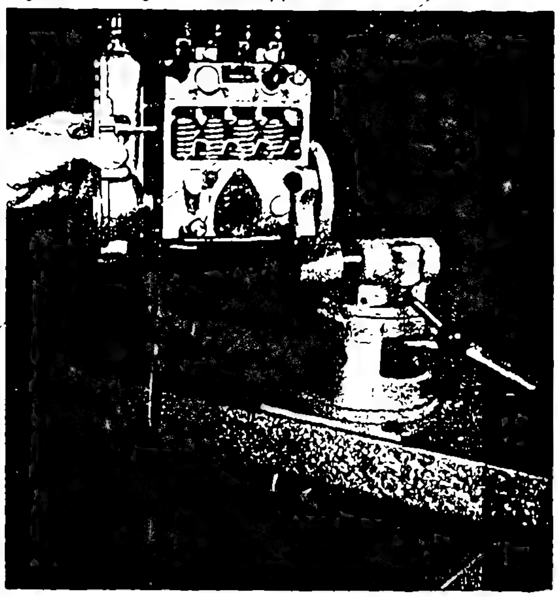

Fig. 11 Removing the governor housing

Unscrew fixing screw (11) in threaded plug (10) and the remaining screws (9). Free housing by light taps with rubber hammer and lift off, collecting lube oil in work bench tray or suitable container (Fig. 11).

If the governor housing has to be exchanged for some reason, stop screw (22) and lock nut (23) must also be unscrewed as must the threaded plug (17 a) at the top of the governor housing.

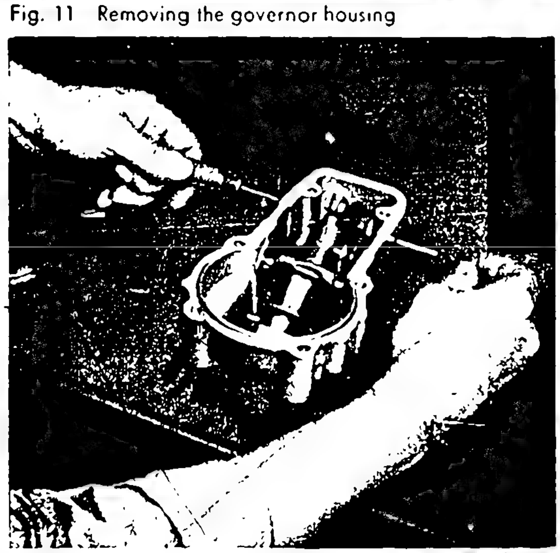

Fig. 12 Removing the lever spindle

2.2. 6. Unscrew the two closure plugs (38) at the top of the housing cover and push out lever spindle (37) (Fig. 12).

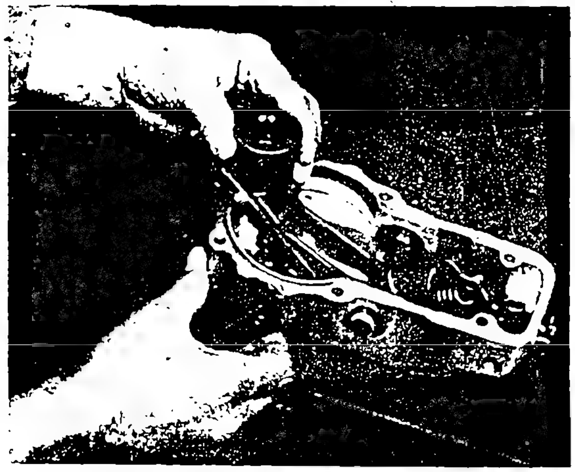

Fig 13 Removing the guide lever

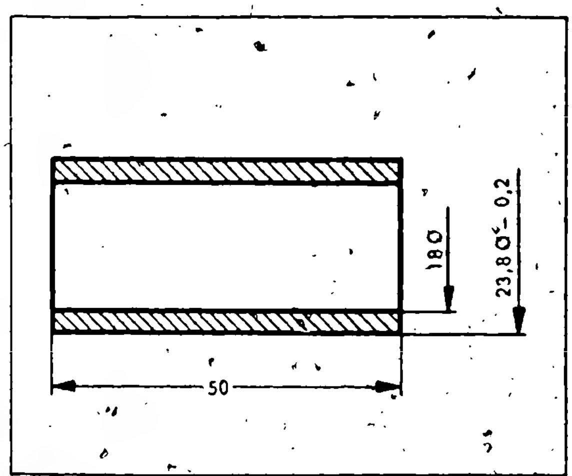

Fig. 14 Auxiliary bush to be made on site

2.2. 7. Manoeuvre guide lever (36) together with governing lever (43) and starting spring (86) as well as knuckle (control plunger) (31) and guide bush (34) as a complete unit **downward** from under swivel lever (50) and remove (Fig. 13). Unhook knuckle from guide lever. If necessary dismantle governing lever from guide lever and also link (48) from governing lever taking care not to lose the starting spring. If guide bush (34) requires replacement or reconditioning, press out knuckle (31) complete with deep-groove or shoulder contact ball bearing (32) and shims (33) using suitable auxiliary bush (Fig. 14). If the knuckle is damaged, this must also be pressed out of the deep-groove or shoulder contact ball bearing taking care not to damage or lose the shims (33).

2.2. 8. Manoeuvre tension lever (35) under swivel lever in an **upward** direction and remove it (Fig. 15). Unhook the governor spring (85) from eye of tension lever and also from the eye in rocker (52) of swivel lever (50).

Fig. 15 Removing the tension lever

2.2. 9. If an additional cut-out mechanism exists (Fig. 16), proceed as follows:
Remove hex. nut (128) complete with spring washer (129) as well as cut-out lever (126), spring capsule (125) and spring (123) taking care not to loose sealing washer (124).
If a cut-out lever with bridge bracket (133 or 134) is fitted, the closure screw (141) on the other side of the governor cover must also be unscrewed taking care that sealing ring (132) is not lost. It is best to leave the small setting plate (136), if undamaged on cut-out lever (133).

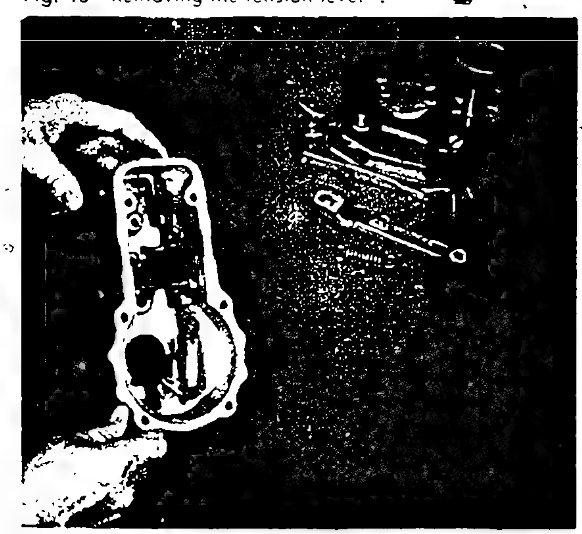

Fig. 16 Governor cover with cut-out mechanism

Fig. 17 Removing cut-out mechanism lever

Prior to removing the lever (118 . . . 122) together with spindle (117) Fig. 17), the stop screw (41) must be unscrewed. To do this lock nut (42) must be released.

If necessary, screw out bearing bush (116).

Fig. 18 Removing the circlips

2.2. 10. If swivel lever (50) is to be removed proceed as follows:

Unscrew hex. screw (70) and remove together with spring washer (71) from control lever (69). Remove sealing washer (61), washer (62) and any shims (63) that may be fitted compensating washer (62). Carefully clamp governor cover in vise. Remove "Benzing" circlips (58) with screwdriver (Fig. 18) using suitable protection pad on cover joint face to avoid damage of the face.

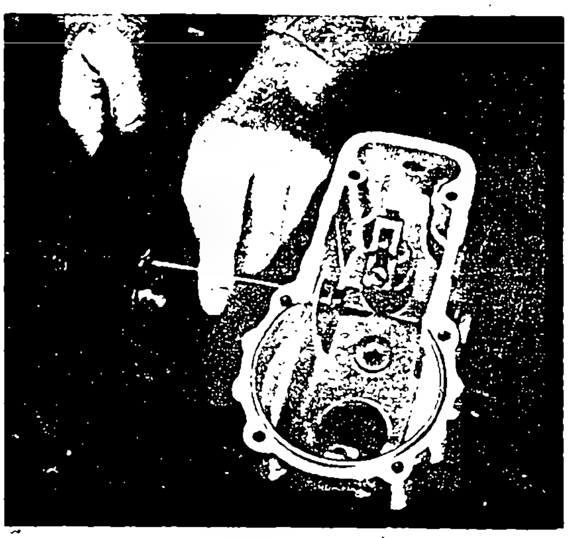

Fig. 19 Removing the bearing bushes

Press swivel lever to one side so that bearing bush (55) can slide out of governor cover (Fig. 19); it can then be removed together with seal (57) and sealing cap (59).

Move swivel lever in opposite direction thus also permitting removal of the second bearing bush. The swivel lever can then be manoeuvred out of the two bearing bores (Fig. 20).

Fig. 20 Removing the swivel lever

If necessary, unscrew adjustment screw (53) from swivel lever. If rocker (52) requires exchanging, press out pin (54).

2.3. Operation sequence
for EP/RSUV governors (see fold-in illustration on rear cover of publication).

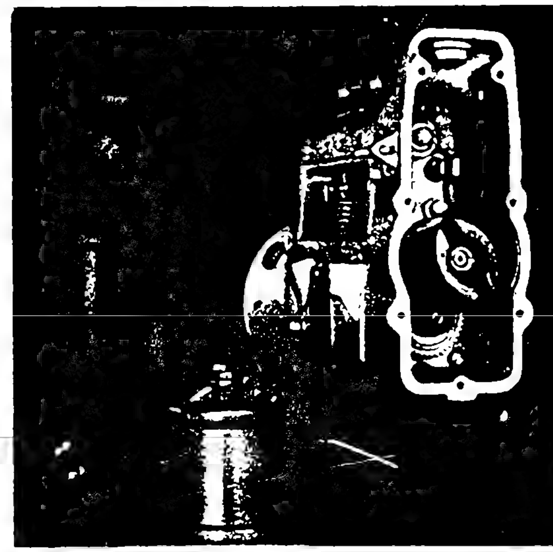

Fig. 21 EP/RSUV governor with cover removed

Points 1 to 4 and 7 to 10 of Section B also apply for dismantling these governors.

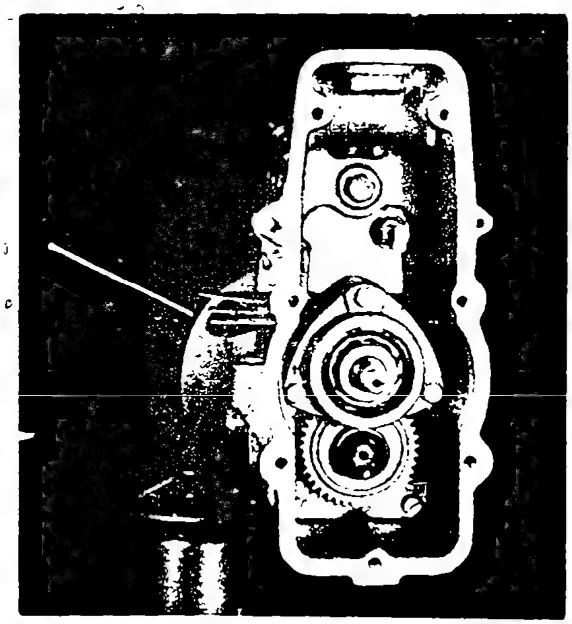

Fig. 22 Flyweight assembly removed

Having removed governor cover (30) (Fig. 21) and flyweight assembly (1) from governor shaft (170) (Fig. 22) proceed as follows:

2.3. 1. Unscrew the three fixing screws (169) on bearing cover (168) of governor shaft (170) removing the screws together with spring washers (169 a) and any plain washers if fitted.

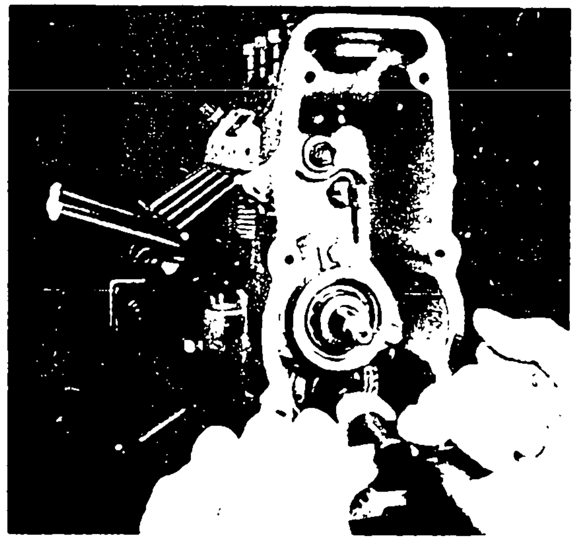

Fig. 23 Releasing the ring nut

2.3. 2. Unscrew ring nut (165) holding drive gear (161) using pin wrench EF 8 101 E, preventing rotation by applying wrench EFEP 119 to the coupling on the opposite side of the pump camshaft (Fig. 23). Remove spring washer (166).

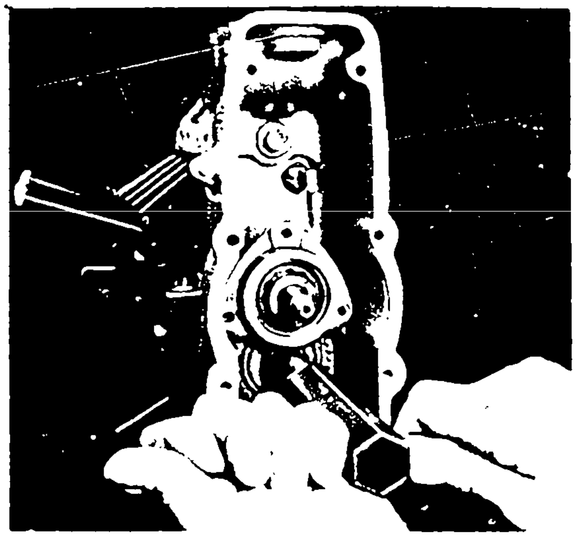

Fig. 24 Releasing the drive gear

2.3. 3. Screw extractor EF 8207 into position and release drive gear (161) from camshaft taper (Fig. 24). The complete removal of the gear, at this stage is prevented by the governor shaft.

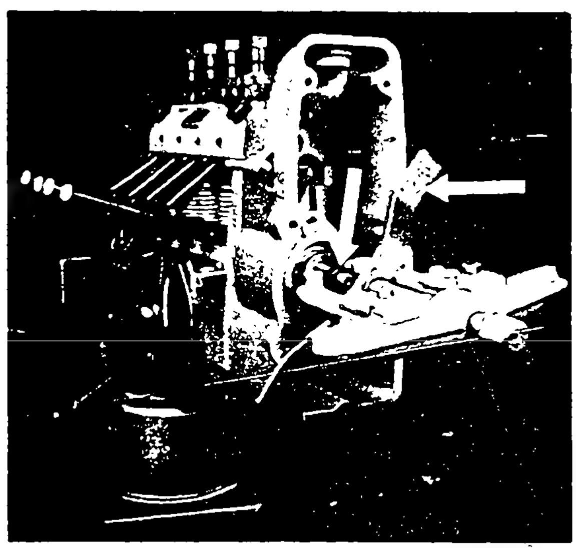

Fig. 25 Extracting the governor shaft complete with bearing cover and drive gear

2.3. 4. Withdraw governor shaft (170) complete with bearing cover (168) and deep-groove radial type ball bearing (171) from governor housing. For this purpose screw a hex. nut (see arrow) on the threaded end of governor shaft, place the claws of a conventional extractor behind this nut whilst supporting the extractor on a cranked steel strip (see arrow) placed across the housing joint face (Fig. 25). The cranked steel strip must be made in the workshop.

B4

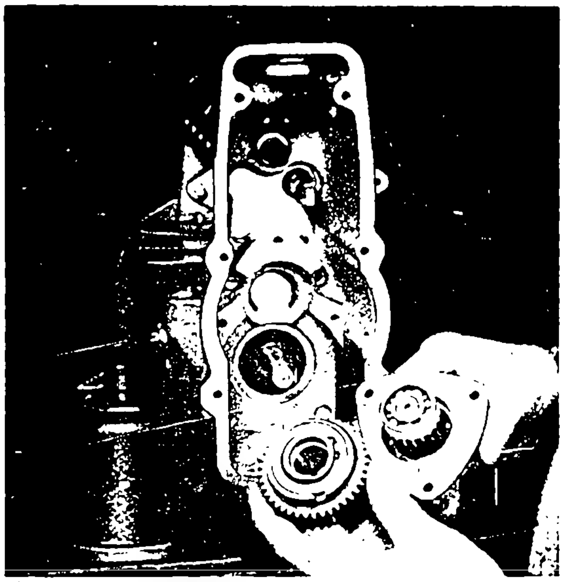

Fig. 26 Dismantled governor shaft with drive gear and bearing cover

During extraction of the governor shaft (170), the drive gear (161) is simultaneously removed from the camshaft (Fig. 26). Remove washer (175) from ball bearing recess.

Remove Woodruff key (5) from the pump camshaft taper.

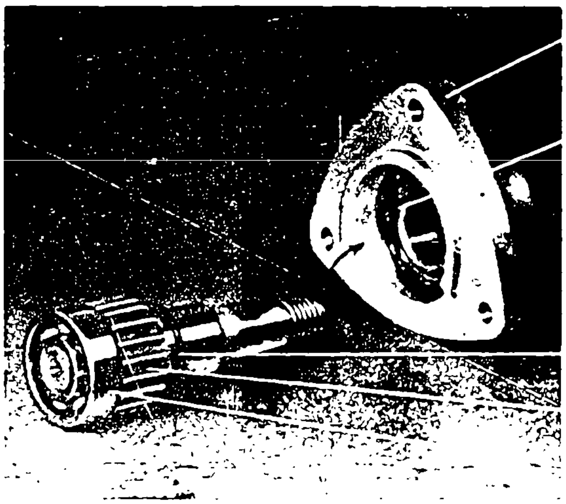

Fig 27 Governor shaft and bearing cover

2.3. 5. If the gear on governor shaft (170) is damaged it must be removed. To do this press governor shaft from bearing cover (168) (Fig. 27). Draw deep-groove ball bearing (171) from governor shaft and remove circlip (174). If necessary, remove inner circlip (173) from bearing cover, using suitable circlip pliers, and press out shoulder contact bearing (172).

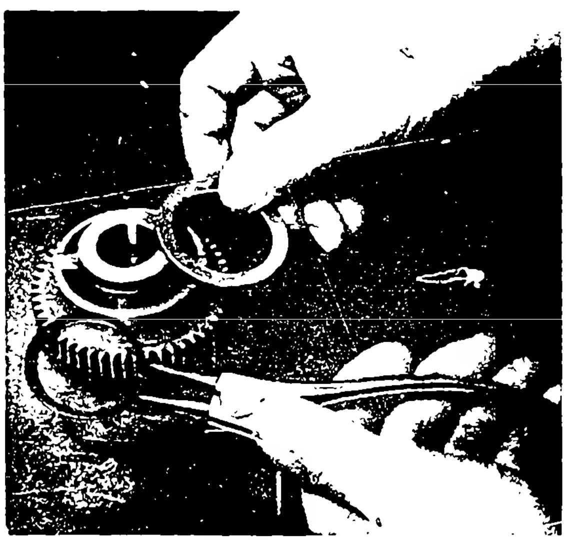

Fig. 28 Removing washer and circlip

2.3. 6. If the rubber damping inserts (162) in the drive gear from the pump camshaft require renewal, remove circlip (164) and lift off washer (163) (Fig. 28). Press hub out of gear thus releasing the four rubber damping inserts.

2.3. 7. The control lever (69) of governors with geared step-up gearing is fixed to the bearing spigot of swivel lever (50) with clamping screw (70) and located by Woodruff key (74). Release clamping screw, withdraw lever and take out Woodruff key.

B5

3. Examination and repair

Thoroughly wash all dismantled components. Removal of used sealing compound at joint faces and registers between governor cover and governor housing as well as governor housing and injection pump requires special attention.

To ensure that governor test results fall within acceptable tolerances it is essential that components are in such condition that they have the dimensions and clearances given under "Assembly". Damaged and worn parts must therefore be renewed.

3.1. Repairs on EP/RSV governors

If rollers, pivot pins and flyweights in the flyweight assembly are worn or damaged, the complete flyweight assembly must be replaced since repair or refitting of individual components in service centres is not worthwhile due to the extensive tooling required (see also BMP 211/25).

Check whether flyweights move freely and can take up the positions shown in Fig. 29.

Check that Woodruff key (5) is still in perfect condition, if not, replace.

On older EP/RSV governors the flyweight assembly was not fitted with rollers. Such flyweight assemblies can be exchanged for the new type but this also necessitates the fitting of a new guide bush. The following table shows a comparison between the old and new versions:

O l d version EP/RSV . . –. . . A 1–9/. . .		N e w version EP/RSV . . –. . . A 1–9/. . .		N e w version EP/RSV . . –. . . A 1–9 A	
Flyweight assembly (1)	Guide bush (34)	Flyweight assembly (1)	Guide bush (34)	Flyweight assembly (1)	Guide bush (34)
PRG 59 S 1 Z	EPMF 37 S 1 X P 2 X	PRG 62 P 1 Z	EPMB 114 P 1 X	PRG 62 P 10 Z	EPMB 114 P 3 X
PRG 59 S 2 Z	EPMF 37 S 1 X P 2 X	PRG 62 P 2 Z	EPMB 114 P 1 X	PRG 62 P 11 Z	EPMB 114 P 3 X
PRG 59 S 3 Z	EPMF 37 S 1 X P 2 X	PRG 62 P 3 Z	EPMB 114 P 1 X	PRG 62 P 12 Z	EPMB 114 P 3 X
PRG 59 P 4 Z	EPMF 37 S 1 X P 2 X	PRG 62 P 3 Z	EPMB 114 P 1 X		

3.1. 1. Examine guide bush (34) to ascertain the condition of the bearing surface for the flyweight rollers. This surface must not be pitted or uneven. If it is marked in any way it is essential that the bush be renewed.

If damaged, exchange deep-groove radial-type ball bearings or in the case of EP/RSUV governors shoulder contact bearings (32) and also knuckle (31) if the spigots are worn.

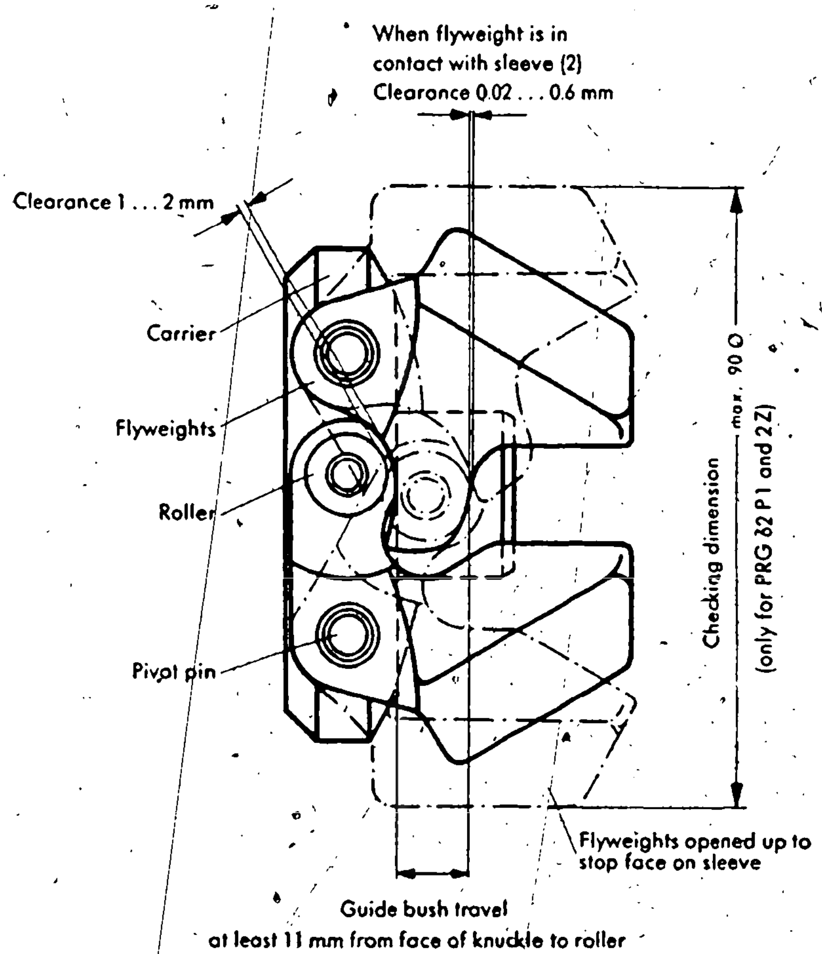

Fig. 29 Standard dimensions for flyweight assembly

3.1. 2. Check whether stop-nose of tension lever (35) is damaged.

All remaining components should be carefully examined and any parts showing serious wear must be replaced. Perfect movement of these components is essential because fouling or excess clearances will result in the control rack no longer reacting smoothly to governor movements which in turn will unfavourably influence engine performance.

3.1. 3. Check stop screw (41) (full load quantity) for pitting and if necessary regrind or replace.

3.1. 4. Check guide lever (36) for condition of slotted holes which act as bearings for the spigots of knuckle (31). These holes must not be worn nor must the guide lever be twisted.

3.1. 5. Check whether governing lever (43) is in good condition. The bottom pin, the bearings for the guide lever pins and the link must not be worn. There must be no excess play between governing lever and guide lever for otherwise the pin engaging in knuckle fork (46) may come out of engagement. Side play can be reduced by inserting shims where necessary.

3.1. 6. If knuckle fork (46) is worn it must be replaced.

3.1. 7. The bearing pins of swivel lever (50), must not have excessive play in the bearing bushes (55). Renew worn components. If the groove for the "Benzing" circlips (58) in the bearing bush is damaged, the groove must be made good or the complete bearing bush replaced.

3.1. 8. The rocker (52) on the swivel lever must not be worn i.e. it must still clamp reliably so that adjusting screw (53) engages correctly. If this is not the case, replace rocker. Bending the rocker to improve contact with screw is not recommended.

3.1. 9. The tapered hole in the control lever (69) must not be worn. This lever must make perfekt contact with the swivel lever bearing pin. In the case of control levers with clamp screw and Woodruff key, the latter must be in perfect condition.

3.1. 10. The cut-out lever (126) must have perfect stop-horns and the surfaces of the two stop pins (130) in the governor cover must be in good condition.

The drive tenons of spindle (117) must fit without appreciable play in the recesses of the bore of the cut-out lever.

3.1. 11. When fitted, the air filter (19) should be washed in petrol and blown out with compressed air.

3.2. Repairs on EP/RSUV governors

On these governors the following points require attention in addition to those enumerated under Section A:

3.2. 1. Replace drive gear (161) if worn badly.

3.2. 2. The rubber damping inserts (162) in the drive gear must be a good fit and still elastic. Hardened or compressed rubber inserts as well as swollen and thus excessively soft inserts should be replaced.

3.2. 3. If gear teeth are worn, replace governor shaft (170). Unless perfect, replace ball bearings (171 and 172). The Woodruff key (167) must be in perfect condition.

4. Assembly

Thoroughly wash repaired and new parts. Moving parts should be oiled with a good engine oil prior to assembly. Assembly takes place in the reverse order to dismantling instructions.

4.1. Operation sequence on EP/RSV governors

4.1. 1. Governor housing (8)

If governor housing (8) was removed or has been replaced, it should be refitted provisionally and all fixing screws tightened securely. Measure projection distance of camshaft taper on drive side with measuring bar EFEP 281; this dimension should be 9.5 ± 0.5 mm (if necessary correct by inserting shims). This same operation is also necessary when only camshaft, ball bearing and bearing cover require replacement. In this instance, the governor housing (8) remains fitted and the necessary work (establishing taper position and camshaft end play) also takes place from the drive side of the pump.

Now fit end play measuring attachment EFEP 225 (for pumps of size A) or EFEP 226 (for Size B) by bolting securely to camshaft taper for which purpose the camshaft should be locked with a piece of wood or plastic block inserted through the feed pump fitting aperture. During this measurement, the pump camshaft must not be under load i.e., the roller tappets should be lifted clear. Insert dial indicator EFAW 7 into measuring attachment.

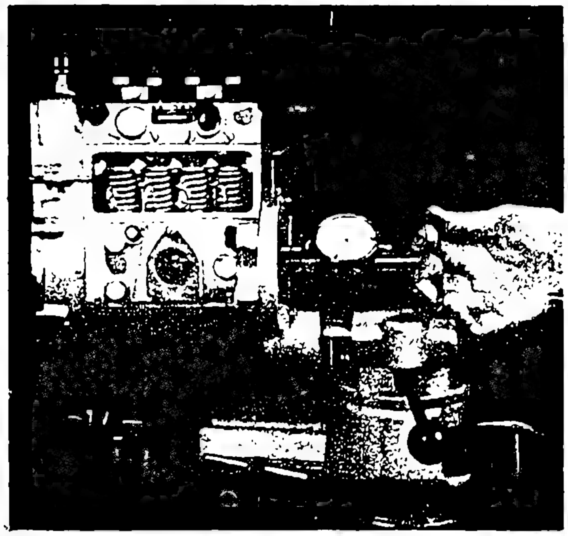
Fig. 30 Measuring camshaft end play

Exert a steady axial pull on attachment (Fig. 30) whilst setting dial indicator to "0". Next exert a steady axial pressure on attachment and read off value.

End play must agree with the following dimensions:

on normal pumps (shoulder contact or deep-groove ball bearings)	0.03 . . . 0.13 mm
on pumps with taper roller bearings	0.02 . . . 0.06 mm
Exception: PES $\frac{4}{6}$ A . . B . . S $\frac{119}{201}$ (special shoulder contact bearing)	0.02 . . . 0.06 mm

Pressure or tension, on the attachment, must be exerted in a precisely axial direction for otherwise faulty measurements will be obtained.

If excessive end play or no play exists, the governor housing must be removed and the camshaft withdrawn. At this stage it is advisable to remove a total shim thickness of at least 0.2 mm since measurements can be taken more readily when excess play exists.

Refit camshaft (where possible leave bearings free from grease packing since grease can influence end play measurement) and secure governor housing using all fixing screws. If the governor housing is provisionally secured with two screws only this will also result in faulty measurements. Measure end play, subsequently, if required, inserting shim washers between spacer ring and ball bearing inner race. Always compensate camshaft end play on the governor side so that prescribed end play is obtained without changing taper position.

Subsequently oil bearing with Ol 1 v 10, cover joint face of governor housing with fresh thin sealing compound (Kk 68 v 1) and fit. Thick sealing compound will again lead to increased end play and should therefore be thinned with trichlorethylene.

Tightening torques

for consecutive No. 11	countersunk screw	1.3 . . . 1.8 kpm
	hex. head screw	1.8 . . . 2.0 kpm
for consecutive No. 9	pump size A	0.6 . . . 0.8 kpm
	pump size B	0.5 . . . 0.6 kpm

Peen countersunk screws.

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4.1. 2. Flyweight assembly (1)

Insert Woodruff key (5) into camshaft keyway and position flyweight assembly. Camshaft and flyweight assembly taper must be absolutely clean.

Position spring washer (7) and screw ring nut (6) into position using pin wrench EFEP 187 A.

Tightening torque for pumps of Size A		5 . . . 6 kpm
	for pumps of Size B	6 . . . 7 kpm

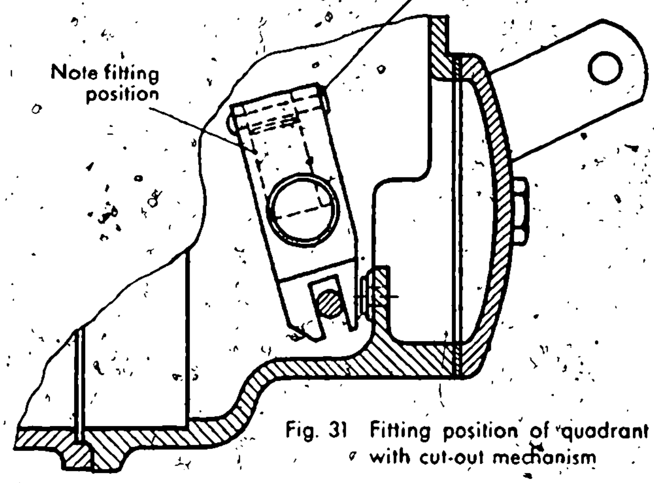


Fig. 31 Fitting position of quadrant lever on governors with cut-out mechanism

4.1. 3. Cut-out mechanism

If the governor is equipped with a cut-out mechanism, this is now fitted as follows:

The position of the governing lever and thus also the position of the quadrant lever (118) depend on the fitting position of the governor.

Fig. 32 Fitting cut-out mechanism spindle

If the governor is to be fitted to the other side of the pump, the lever (118) must also be reversed to ensure correct fitting position (Fig. 31). For this purpose remove rivet head (122), rivet, retaining pad (121), springs (120) and spring follower (119) when spindle (117) can be reversed. A new rivet must be used on re-assembly.

Insert the complete assembly (117 and 118) into guide bush (116) having thoroughly greased 117 with grease Ft 1 v 8 (Fig. 32). Place sealing ring (124) correctly into bearing bush or else this will otherwise bind later, thoroughly grease hooked spring (123) with grease Ft 1 v 8 and place spring capsule (125) in its position in the governor housing.

Insert the end of the hooked spring projecting from the spring capsule, into the hole provided for this purpose in the cut-out lever (126) (Fig. 33) and only at this stage allow the spindle (117) drive tenons to engage in the cut-out lever (Fig. 34).

Secure cut-out lever with hex. head screw (128) and spring washer (129).

If a bridge-type cut-out lever is fitted, threaded bush (131) has to be screwed into the opposite side of the governor cover in lieu of closure plug (98). The bridge (135) is then secured with plug (141). Do not forget sealing ring (132) in threaded bush (131).

Plug (141) simultaneously serves as an oil level plug.

Check cut-out lever for ease of movement.

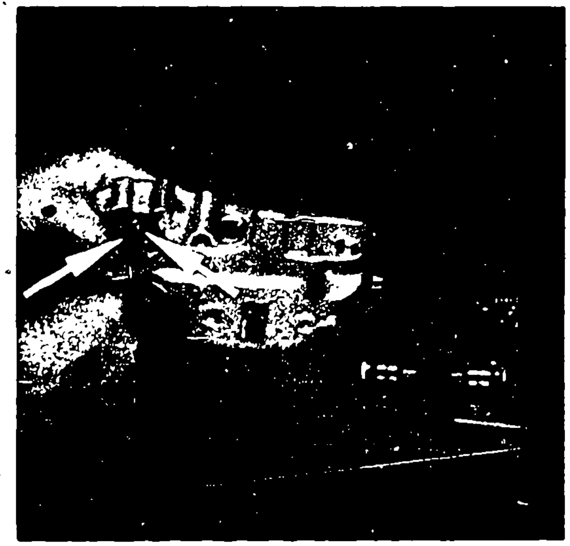


Fig. 33 Insert end of hooked spring into cut-out lever hole

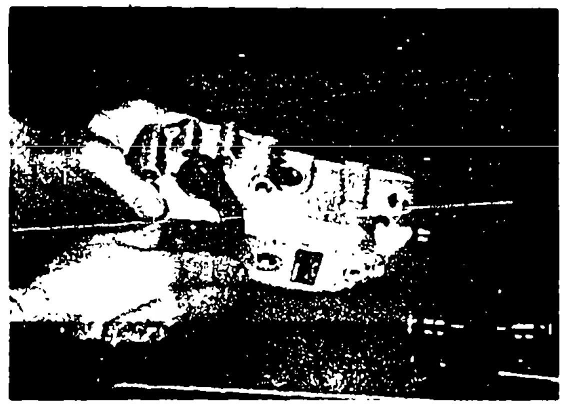


Fig. 34 Insert spindle drive tenons into tenon recesses in cut-out lever

4.1. 4. Full-load stop (41)

At this stage temporally screw stop screw (41) into governor cover (Fig. 35) until it engages with lock nut (42).

Fig. 35 Inserting the stop screw

4.1. 5. Swivel lever (50)

If rocker (52) on the swivel lever was renewed, it must be secured with the aid of pin (54). At this stage provisionally insert adjusting screw (53).

Insert swivel lever bearing spigots into the two governor cover bearing bores so that the groove in the lever is uppermost. Insert the two bearing bushes (55) with sealing rings (57), from the outside, into the governor cover, sliding them over the swivel lever bearing spigots (bearing bush with sealing cap (59) on the side opposite to the control lever).

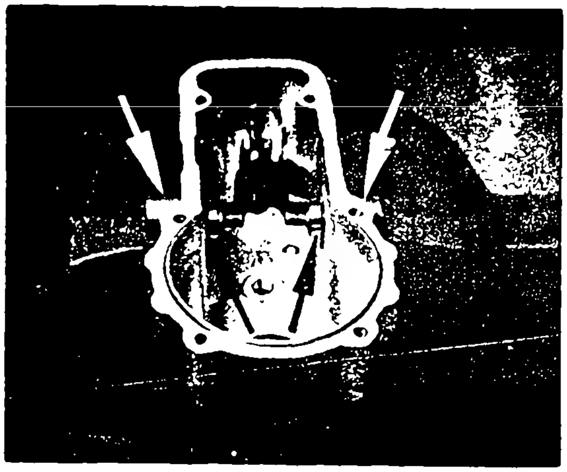


Fig. 37 Pressing bearing bushes into final position using assembly aid bushes

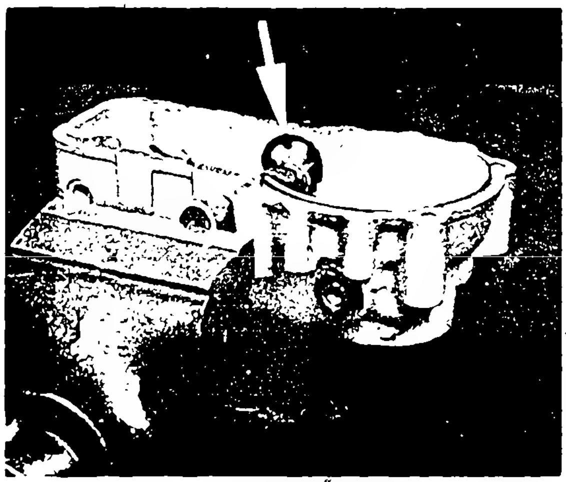


Fig. 38 Snapping circlips into position

Using the two assembly aid bushes (sketch 36) firmly press bearing bushes into position so that

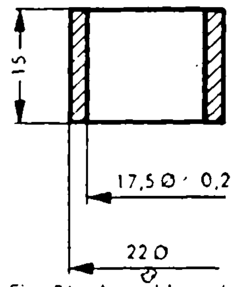


Fig 36 Assembly aid bush for pressing bearing bushes into governor cover.

the grooves for circlips (58) become accessible (Fig. 37). At this stage snap circlips into position (Fig. 38).

If the swivel lever has excess end play this can be reduced by inserting spacer shims between bearing bush and bearing spigot.

4.1. 6. Control lever (69)

Insert bearing bush (55) and sealing ring (61), place washer (62) into position and fit control lever. If pressure on the sealing ring proves inadequate, insert compensating shims (63) to suit.

Securely lock control lever with hex. head screw (70) and spring-washer (71). Check ease of movement of swivel lever by moving control lever backwards and forwards (Fig. 39).

4.1. 7. Guide bush (34)

Prior to fitting the guide bush, check fitting dimension for knuckle (31).

Insert deep-groove radial type ball bearing (32) into guide bush (34) (note sliding fit BMP 211/21). Place guide bush on rollers (4/1) of flyweights (1) (flyweights in rest position) and measure with the aid of a depth gauge the distance from the face of the deep-groove ball bearing inner race to the contact face of the housing cover (Fig. 40). Now select the correct thickness of shim-washers (33) to give the following dimensions.

15	± 0.2 mm	for EP/RSV	A..	Governor
19		"	A.. A and A.. B	"
3		"	B../..	"
10.5		"	B.. A.. and B.. B..	"
19		"	M../..	"
19		"	M.. A.. and M.. B..	"
19		"	P../..	"

(See Fig. 41)

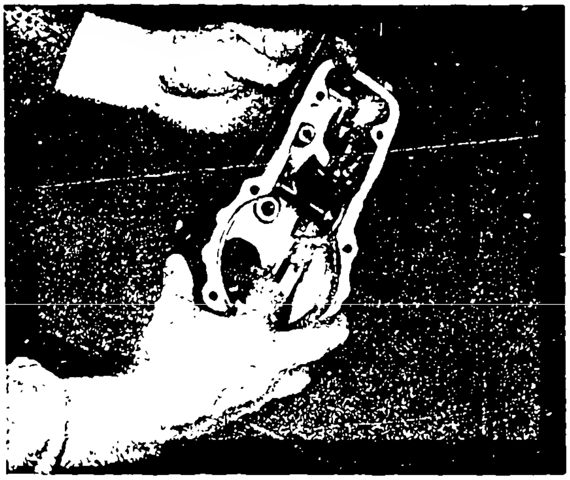


Fig. 39 Checking swivel lever for ease of movement

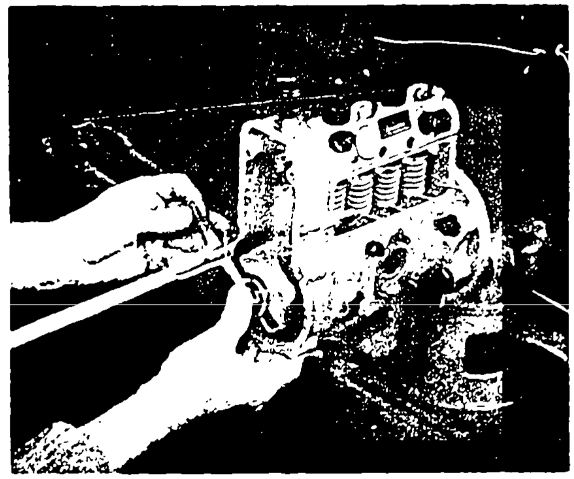


Fig. 40 Checking fitting dimension of knuckle

Place these shim washers on the shank of knuckle (31) and press deep-groove radial type ball bearing into position (exert pressure on inner race). Again slide deep-groove ball bearing and knuckle into guide bush.

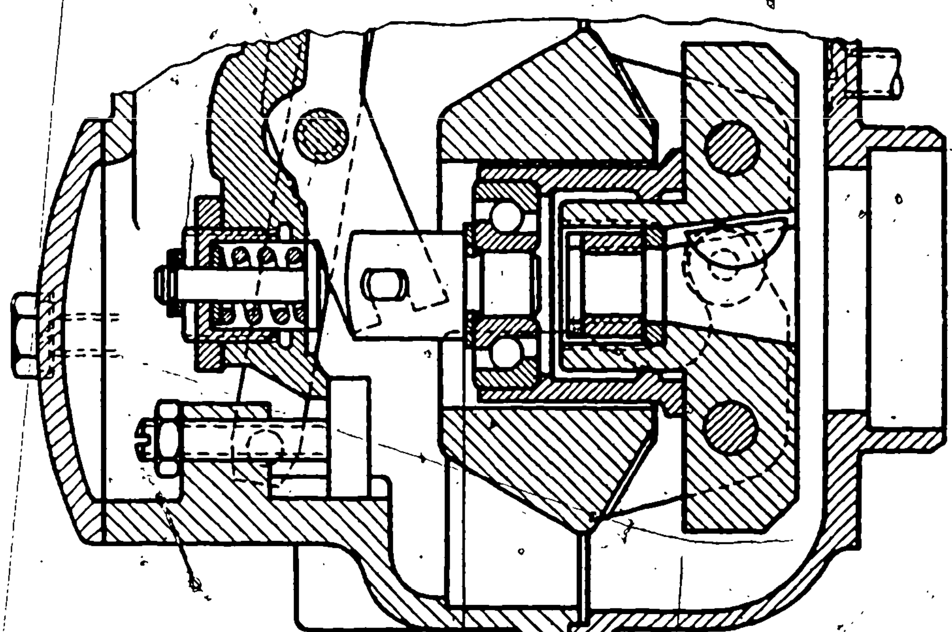


Fig. 41 Setting dimension = distance from contact face of knuckle to contact face of housing cover)

Fig. 42 Inserting the guide lever

Fig. 43 Locating guide lever with lever spindle

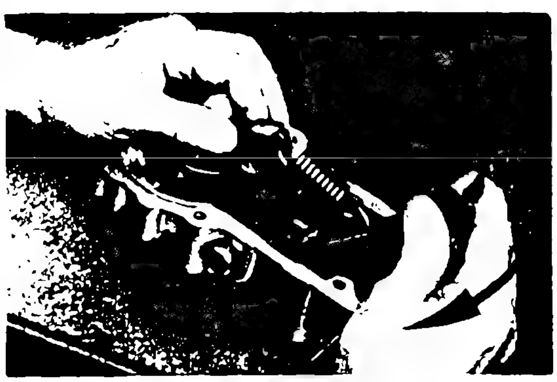


Fig. 44 Inserting the tension lever

4.1. 8. Guide lever (36)

Insert knuckle (31) complete with guide bush into the slotted holes at the lower end of the guide lever.

Insert guide lever with governing lever (43) and link (48) into governor cover in such a manner that it can be pushed under the swivel lever from below (Fig. 42). Now insert governing lever pivot into knuckle fork (46). On governors with cut-out lever, adjust this lever so that the governing lever pivot can be engaged in the groove of quadrant lever (118).

Insert lever spindle (37) into governor cover only sufficiently far to provisionally hold one leg of the guide lever (Fig. 43).

Hook starting spring (86) into eye of governing lever.

Attention!
On EP/RSV governors of Size B hook starting spring into eye under the link fastening.

4.1. 9. Tension lever (35)

Provisionally screw spring capsule (39) into tension lever and secure with lock nut (40). Engage governor spring (85) in tension lever and rocker (52). Now manoeuvre tension lever from above under the swivel lever into the governor cover (Fig. 44) so that the stop nose reaches a position behind the full-load stop screw (41).

Now feed lever spindle (37) through holes in both guide and tension levers, tightening both plugs (38) securely.

4.1. 10. Governor cover (30)

Cover joint face of governor cover with sealing compound Kk 68 v 1 and offer up close to governor housing. Hook starting spring (86) into eye (21) in governor housing (see also Fig. 7). Connect pivot link (48) with injection pump control rack securing with leaf spring (on certain governors this connection is made with washer and split pin (49) (see also Fig. 6).

Place governor cover on governor housing, loosely securing with cheesehead screw (150) and spring washers (152). The control rack should now be checked for ease of movement prior to final tightening of the fixing screws. Push control rack to "stop" and release; control rack must automatically return to "full-load." Repeat this test several times. Finally, tighten fixing screws. Tightening torque 0.5-0.7 kpm (3.6-5.1 lb. ft).

4.1. 11. Stop screw (87)
Provisionally screw in stop screw, fit lock nut (88) and cap nut (89).

4.1. 12. Auxiliary idling spring (93)
Fit adjusting screw (92) and auxiliary spring (93) into governor cover. Screw on hex. nut (94), insert sealing ring (96) into cap nut (95) and secure.

4.1. 13. End cover plate (142)
Place gasket (143) into position, firmly secure cover plate lith hex. headed screws (144) and spring washers (145).

4.1. 14. Final operations and leakage test
Screw closure plug (17 a) into governor housing.

If an air filter (19) is provided, screw it into its adaptor (17 c). Place sealing ring (20) into position and screw in air filter.

If stop screw (22) was unscrewed, fit it in provisionally and secure with lock nut (23). From the pump remove tappet holders and screw injection pump cover into position.

Fit feed pump or cover plate to injection pump.

Pour in fresh lubricating oil (Ol 1 v 10) via covered oiler (97) until oil runs from threaded plug (98 or 141).

Also fill camshaft chamber of injection pump up to mark on dipstick with oil (Ol 1 v 10).
Fit pump with governor to test bench and adjust.

Remove pump from test bench and empty lubricating oil from governor housing. Blow compressed air into governor housing at a pressure of 0.2 atmospheres via covered oiler, having covered all joint faces and threaded plugs or connections with Ol 61 v 11 using a brush; in this way leaks can be detected. This is of particular importance on governors with a cut-out lever.

Having completed setting and leak tests, lead-seal governor (Fig. 45). Again check control rack for easy movement as described under 4.1. 10.

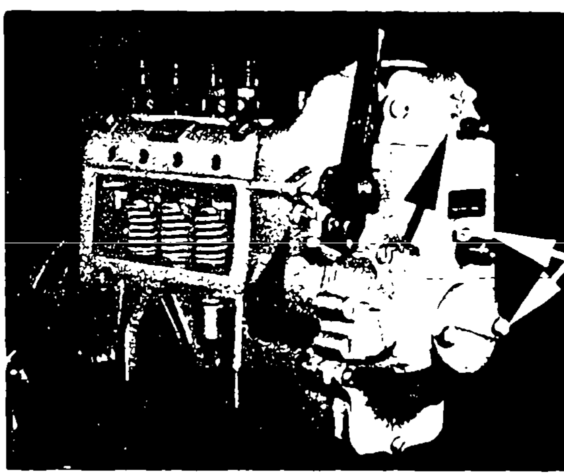


Fig 45 Lead-sealing the governor

Fig. 46 Fitting rubber damper inserts

4.2. Additional operations on EP/RSUV governors

Operations 1, and 3 to 14 as given in Section A also apply to governors with step-up gearing.

After fitting the governor housing proceed in accordance with the following instructions:

4.2. 1. Governor shaft (170) and bearing cover (168)

Press deep-groove ball bearing (171) onto governor shaft (170). Snap circlip (174) into groove in governor shaft groove.

Press shoulder contact bearing (172) into bearing cover (168) (wide face of outer race to register shoulder) and secure with internal circlip (173). Now press governor shaft into inner race of shoulder contact bearing whilst supporting the latter with a suitable piece of tubing.

4.2. 2. Drive gear (161)

Assemble hub and drive gear ring.

Insert rubber dampers (162) using a small screwdriver to assist if necessary (Fig. 46). Place washer (163) into position and secure circlip (164) using suitable pliers.

4.2. 3. Fit governor shaft and drive gear

Insert Woodruff key (5) into injection pump camshaft. The key must be a tight fit in its groove.

Push drive gear onto taper but only so that it just engages with the Woodruff key (Fig. 47). Insert washer (175) into the register for the governor shaft (170) deep-groove ball bearing (171).

Insert governor shaft (bearing has sliding fit) (Fig. 48) This should simultaneously slide the drive gear onto the camshaft taper.

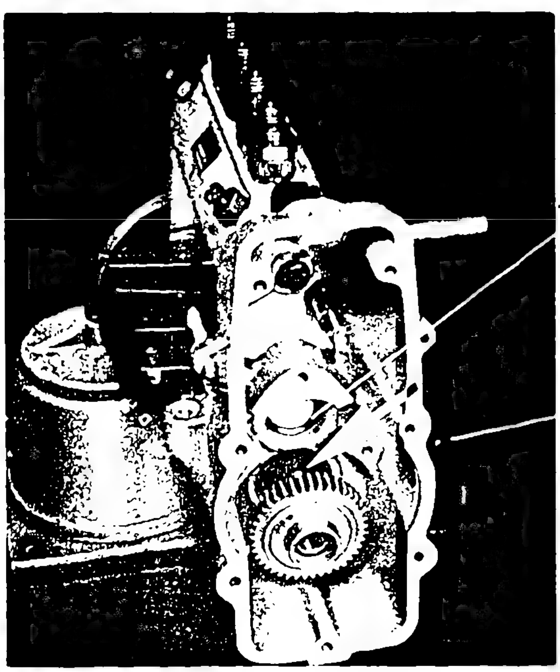


Fig. 47 Fitting the drive gear

Fig 48 Fitting the camshaft with bearing cover

Secure bearing cover with hex. headed screws (169), spring washers and plain washers.

Place spring washer (166) on camshaft taper tightening ring nut (165) with pin wrench EF 8101 E whilst preventing rotation with wrench EFEP 119 applied to coupling on opposite end of camshaft. Tightening torque 8.5 . . . 10 kpm (61-72 lbft.).

4.2. 4. Flyweight assembly (PRG component) (1).

Place spacer ring (176) on governor shaft.

Insert Woodruff key (167) into governor shaft keyway and fit flyweight assembly. Governor shaft and flyweight assembly tapers must be absolutely clean.

Fit spring washer (7) and tighten ring nut (6) with pin wrench EFEP 187 A preventing rotation with wrench EFEP 119. Tightening torque 6 . . . 7 kpm (43-51 lbft.).

4.2. 5. Guide bush (34)

EP/RSUV . . B governors latterly incorporate a double shoulder contact bearing (32). This bearing must be pressed in on assembly with at least 80 kg (175 lb.) pressure and must be positioned so that the ball filling groove comes into contact with the register shoulder.

The fitting dimension on these governors is 18.5±0.2 mm (see also Section IV A, 7).

Should an old single-row angular contact bearing still be found, this should be replaced by the new double-row bearing NKL 36/10 Z. At the same time, a new guide bush EPMB 114 P 3 X and new knuckle EPGK 32 P 3 X must also be fitted.

4.3. "A" modification on governors EP/RSV.. – ..A...A, EP/RSV.. – ..B...A and EP/RSUV.. – ..B...A

The designations of components used in the "A" versions can be found in the illustrations and number codes given in the illustration sheets appropriate to the given governor. They appear at the end of the instruction booklet or the spare parts lists.

The "A" modification features the following characteristics:

1. Deep-hole governor housing with radial sealing ring for camshaft sealing: with air filter Item 10-26 (EP/RSV), Item 30-41 (EP/RSUV).
2. Two additional screws for fixing to pump housing: cheesehead screws in lieu of countersunk screws, Items 14, 15 (EP/RSV), Items 34, 35 (EP/RSUV).
3. Longer link between governing lever and control rack. Item 49 (EP/RSV), Item 71 (EP/RSUV).
4. Hub of flyweight assembly longer and stepped on face. Item 1 (EP/RSV and EP/RSUV).
5. Double-row shoulder contact bearing in guide bush (governor sleeve). Item 31, 33 (EP/RSV), Items 52, 54 (EP/RSUV).
6. Transmission of centrifugal forces to guide bush via sliding tenons (formerly rollers). Fig. 1 (EP/RSV and EP/RSUV).
7. Tension lever with truncated stop nose. Item 34 (EP/RSV).
8. Control plunger knuckle pressed into guide lever. Item 35 (EP/RSV), Item 56 (EP/RSUV).
9. Closed bearing bores in guide lever for pressed-in control plunger knuckle (formerly knuckle with turned and milled plunger and positioned in guide lever by slot). Item 35 (EP/RSV), Item 56 (EP/RSUV).
10. Gaskets between pump housing and governor housing, governor housing and governor cover as well as between governor cover and end cover plate. Item 16, 129 (EP/RSV), Item 36, 139 (EP/RSUV).
11. Dipstick in end cover plate; cover plate secured with four screws. Items 116, 115 (EP/RSV), Items 127, 125 (EP/RSUV).
12. Lower bearing of governing lever as well for knuckle fork and for cut-out lever is fitted with a slider. Items 44-46 (EP/RSV), Items 66-68 (EP/RSUV).

The **earliest** governors in "A" version (but not on EP/RSUV..B..A..) still incorporate single row shoulder contact bearings **WKL 1 S 1 Z. For these are required for compensation:**

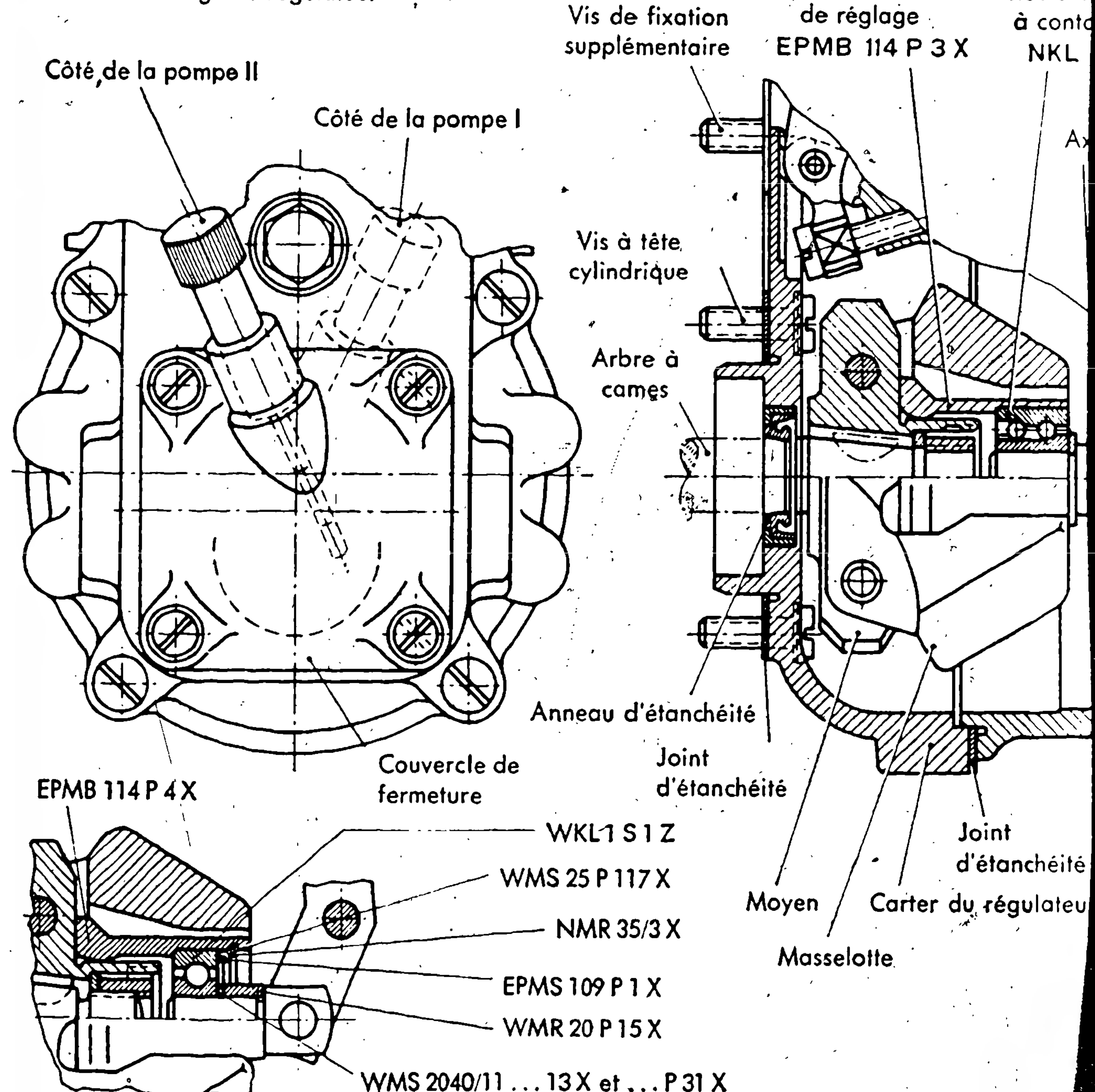
1 Washer	WMS 25 P 117 X
1 Washer	EPMS 109 P 1 X
1 Circlip	NMR 35/3 X
1 Ring	WMR 20 P 15 X
Compensating shims as required	WMS 2040/11 . . . 13 X, . . P 31 X

If the single row shoulder contact bearing is damaged, it should be replaced by pressing the double row bearing WKL 3 P 1 Z and guide bush EPMB 114 P 3 X (NKL 42/10 Z can be used up). This then eliminates all the washers and rings mentioned above **with exception of the compensating shims as required** (see Fig. 49, Page 25).

The following new fitting dimensions (measured with flyweights at inner = rest position) apply to **"A" versions:**

EP/RSV . . A . . A . .	19 ± 0.2 mm
EP/RSV . . B . . A . .	10.5 ± 0.2 mm
EP/RSUV . . B . . A . .	18.5 ± 0.2 mm (unchanged)

Position de la jauge pour le montage du régulateur



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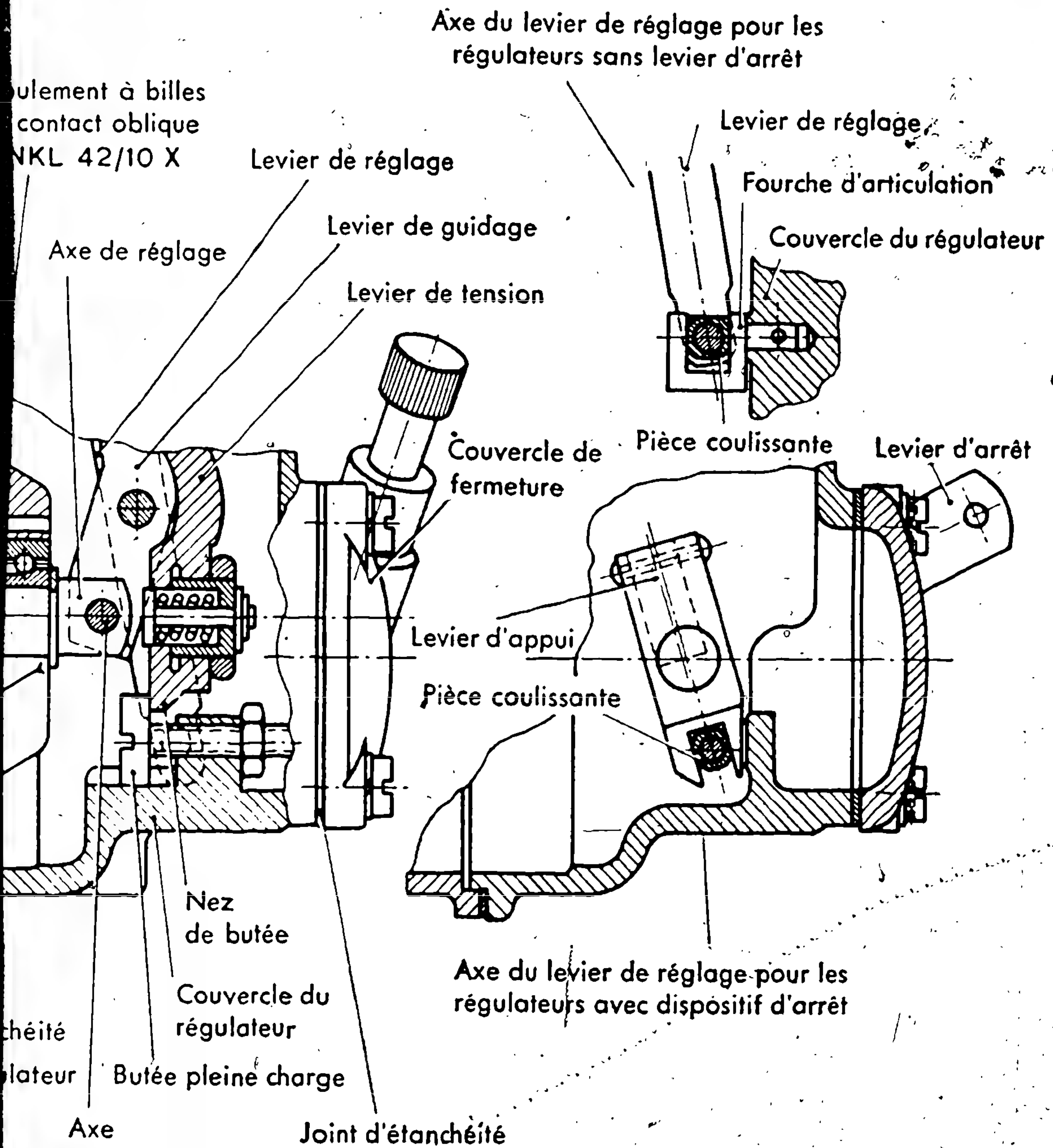
Axe du levier de réglage pour les régulateurs sans levier d'arrêt
ulement à billes contact oblique NKL 42/10 X
Levier de réglage
Levier de guidage
Axe de réglage
Levier de tension
Levier de réglage
Fourche d'articulation
Couvercle du régulateur
Couvercle de fermeture
Pièce coulissante
Levier d'arrêt
Levier d'appui
Pièce coulissante
Nez de butée
Couvercle du régulateur
héité
lateur
Butée pleine charge
Axe
Joint d'étanchéité
Axe du levier de réglage pour les régulateurs avec dispositif d'arrêt

5. Special tools and fixtures

Tool	Former designation	Order No.	Utilization
Vise	EF 8 498	**0 681 240 048**	for clamping pump
Angle clamping bracket	EF 8 498/30	**1 688 010 002**	for clamping PES pump in conjunection with EFEP 8498
Socket wrench	EFEP 202	**1 687 950 013**	for tightening and adjusting spring capsule
Pin wrench	EFEP 187 A	**1 687 950 012**	for slackening and tightening flyweight assembly ring nut
Extractor	EFEP 8 449	**1 680 363 001**	for extracting flyweight assembly
Extractor	EFEP 8 132	**0 681 342 002**	for extracting flyweight assembly
Tappet holder (for Size A)	EFEP 311	**1 682 027 001**	for holding tappets in upper clear position when fitting governor housing
Tappet holder (for Size B)	EFEP 312	**1 682 027 002**	for holding tappets in upper clear position when fitting governor housing
Tappet holder (for high-speed pump Size A)	EFEP 205	**1 684 682 003**	for holding tappets in upper clear position when fitting governor housing
Pin wrench	EF 8 101 E	**1 687 950 025**	for loosening ring nut on drive gear of EP/RSUV governors
Extractor	EF 8 207	**0 681 342 004**	for withdrawing drive gear on EP/RSUV governors
Measuring bar	EFEP 281	**1 685 439 508**	for measuring projection dimension on camshaft taper
End-play measuring attachment (for Size A)	EFEP 225	**0 681 440 011**	for measuring camshaft end-play
End-play measuring attachment (for Size B)	EFEP 226	**0 681 440 012**	for measuring camshaft end-play
Dial indicator	EFAW 7	**1 687 233 011**	for use with EFEP 225 and EFEP 226
1 Auxiliary bush (make on site)	Page 7, Fig. 14		for pressing ball bearing out of guide bush
2 Assembly aid bushes (make on site)	Page 18, Fig. 36		for pressing bearing bushes into governor cover

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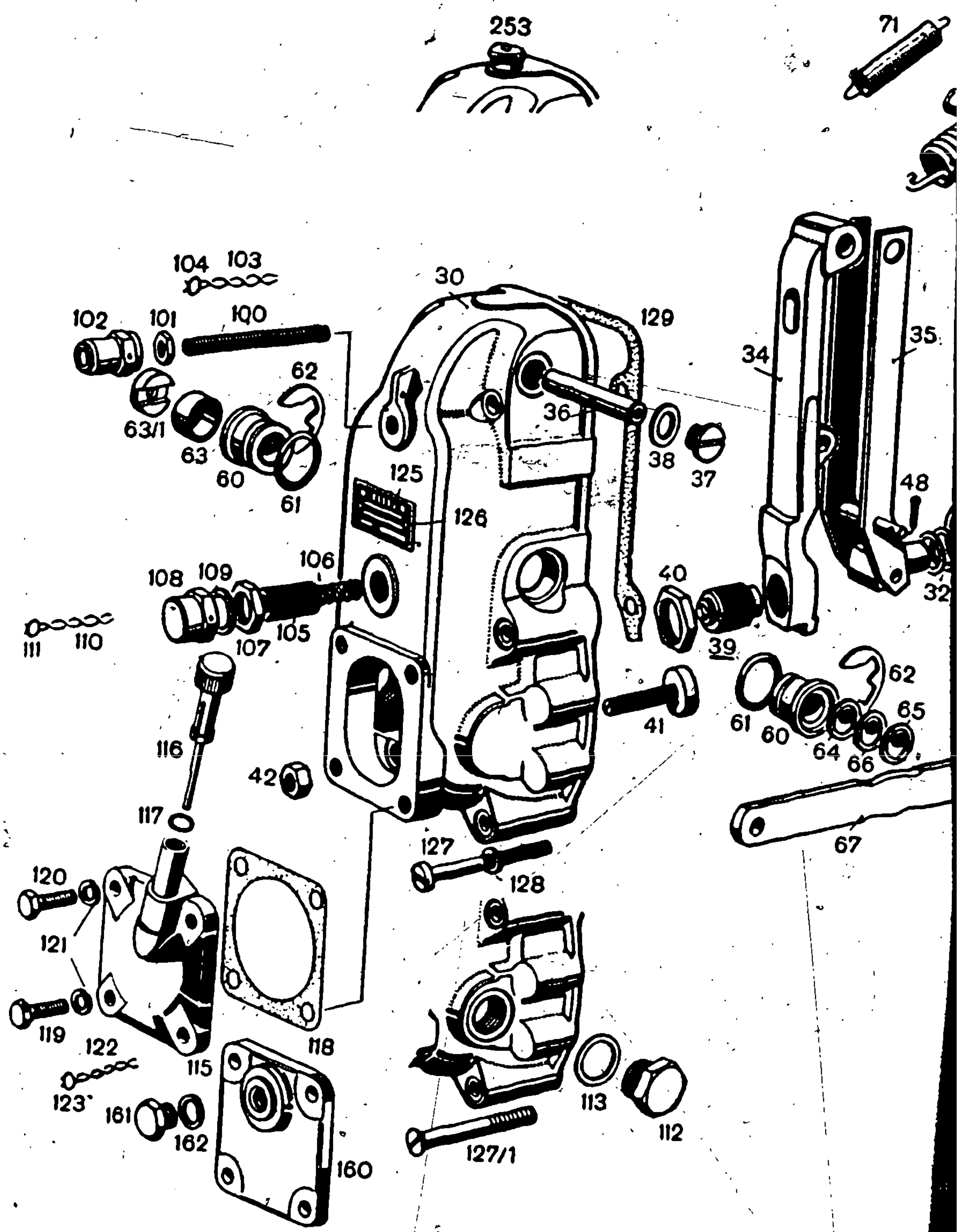
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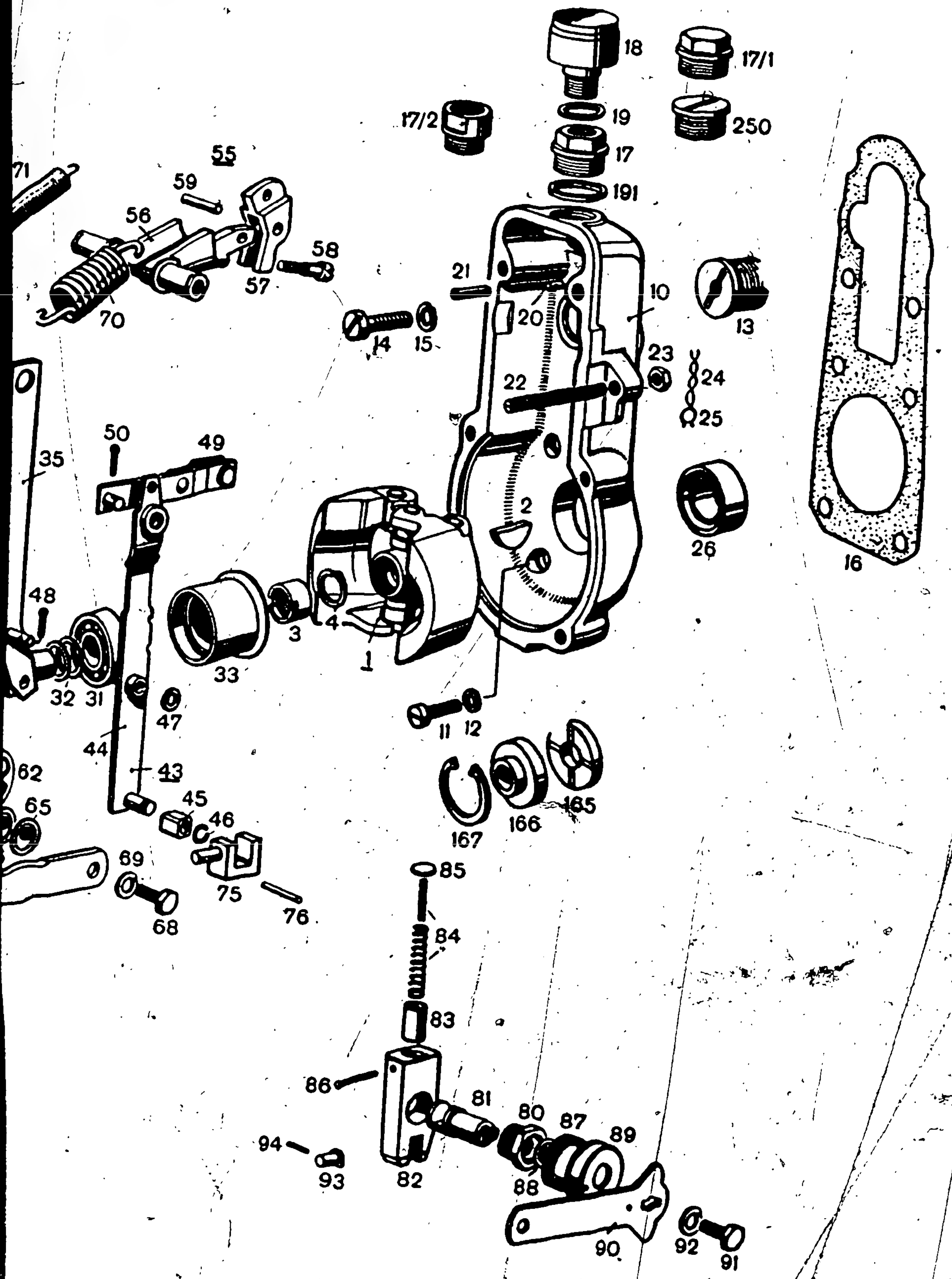
EP/RSV ... A ... A



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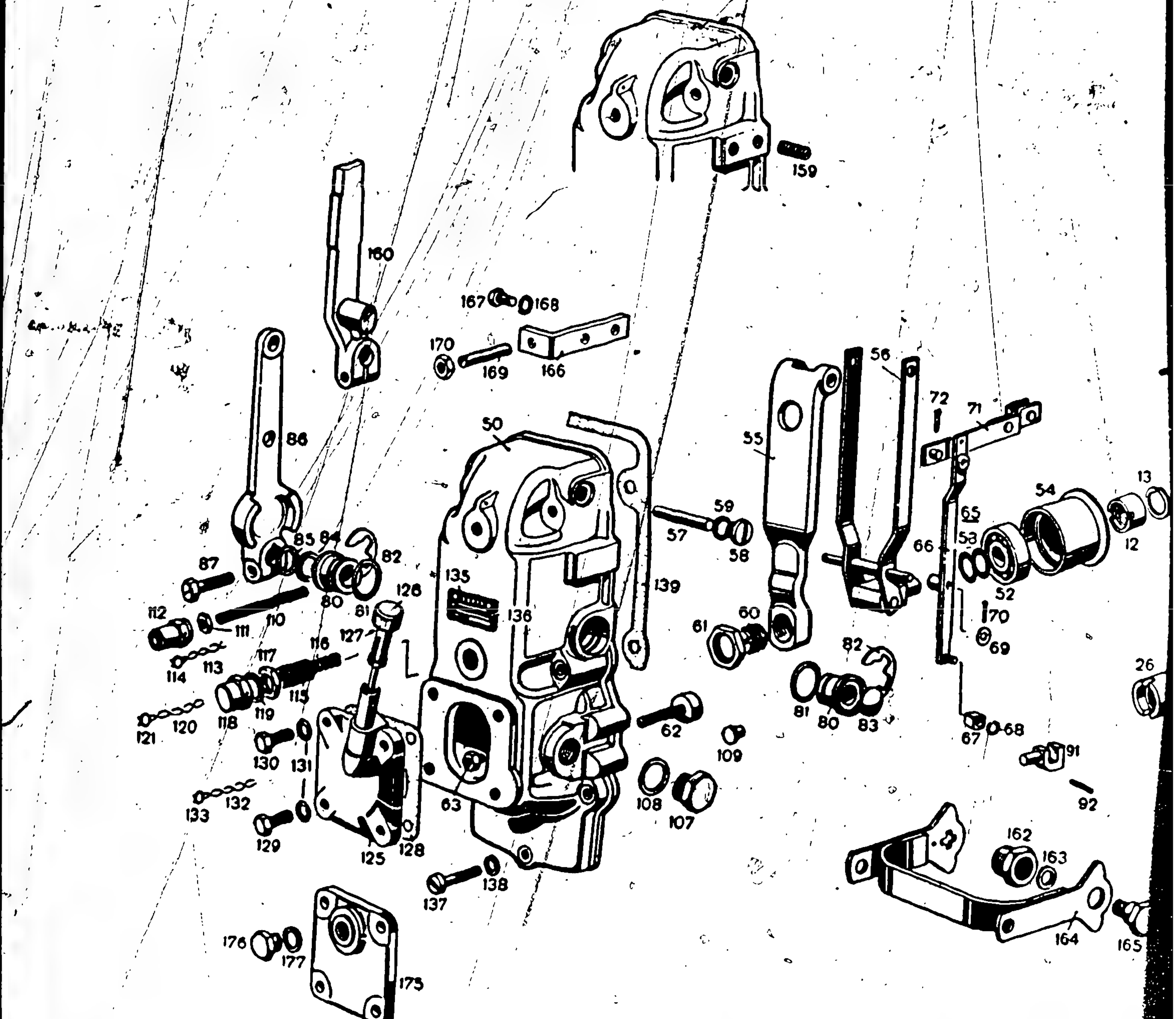

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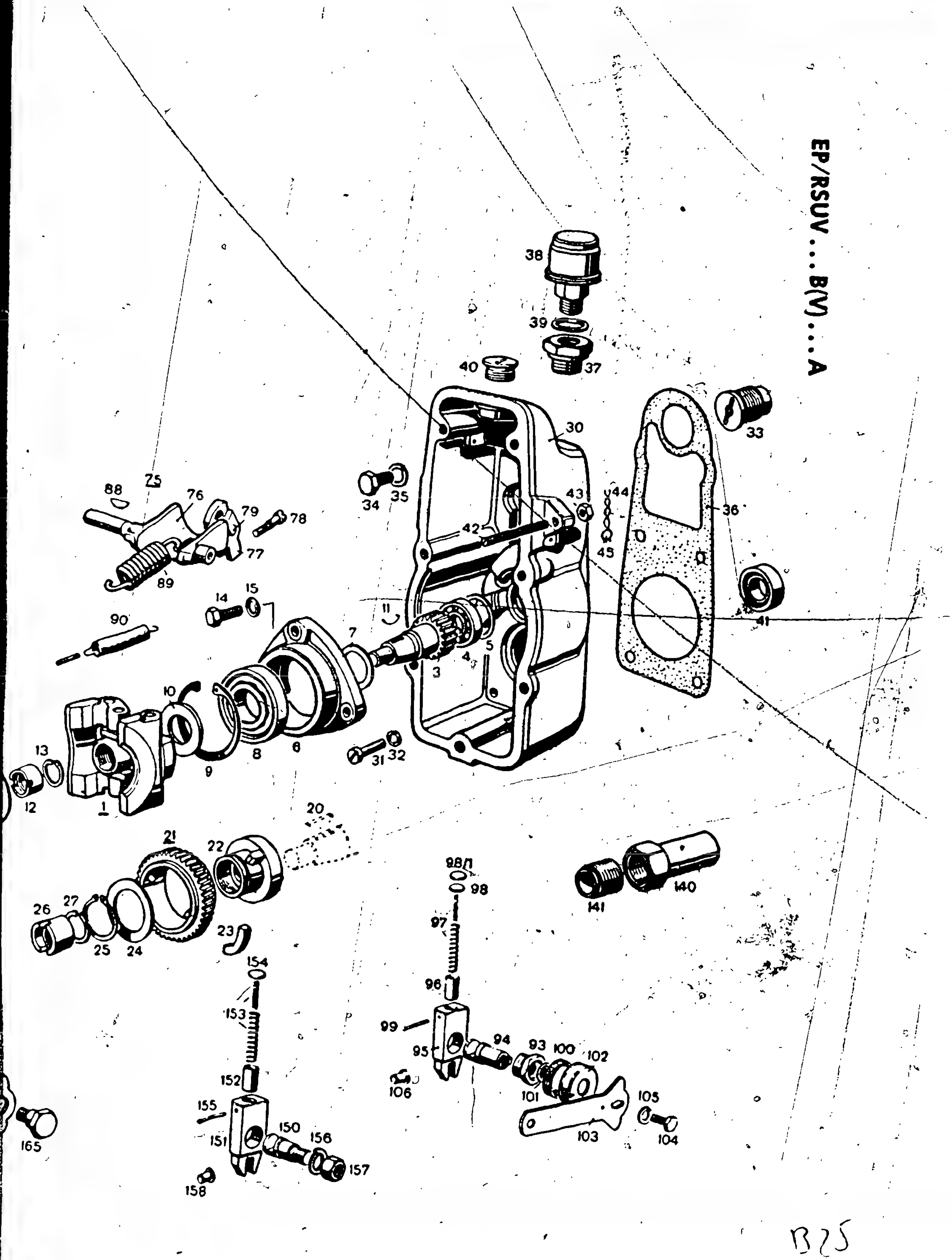
EP/RSUV...B(V)...A



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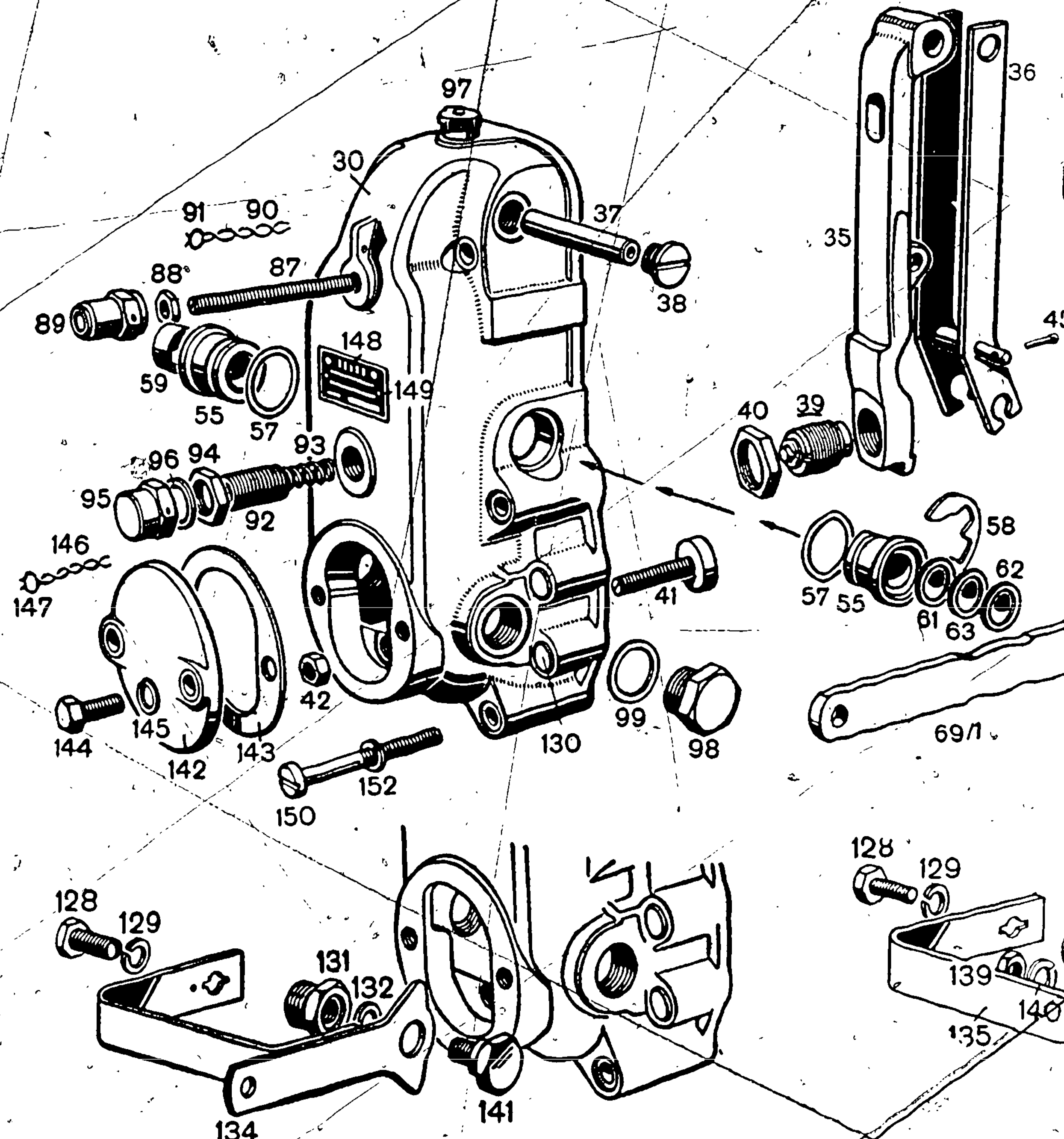
Centrifugal governor EP/RSV .. A/B ../...



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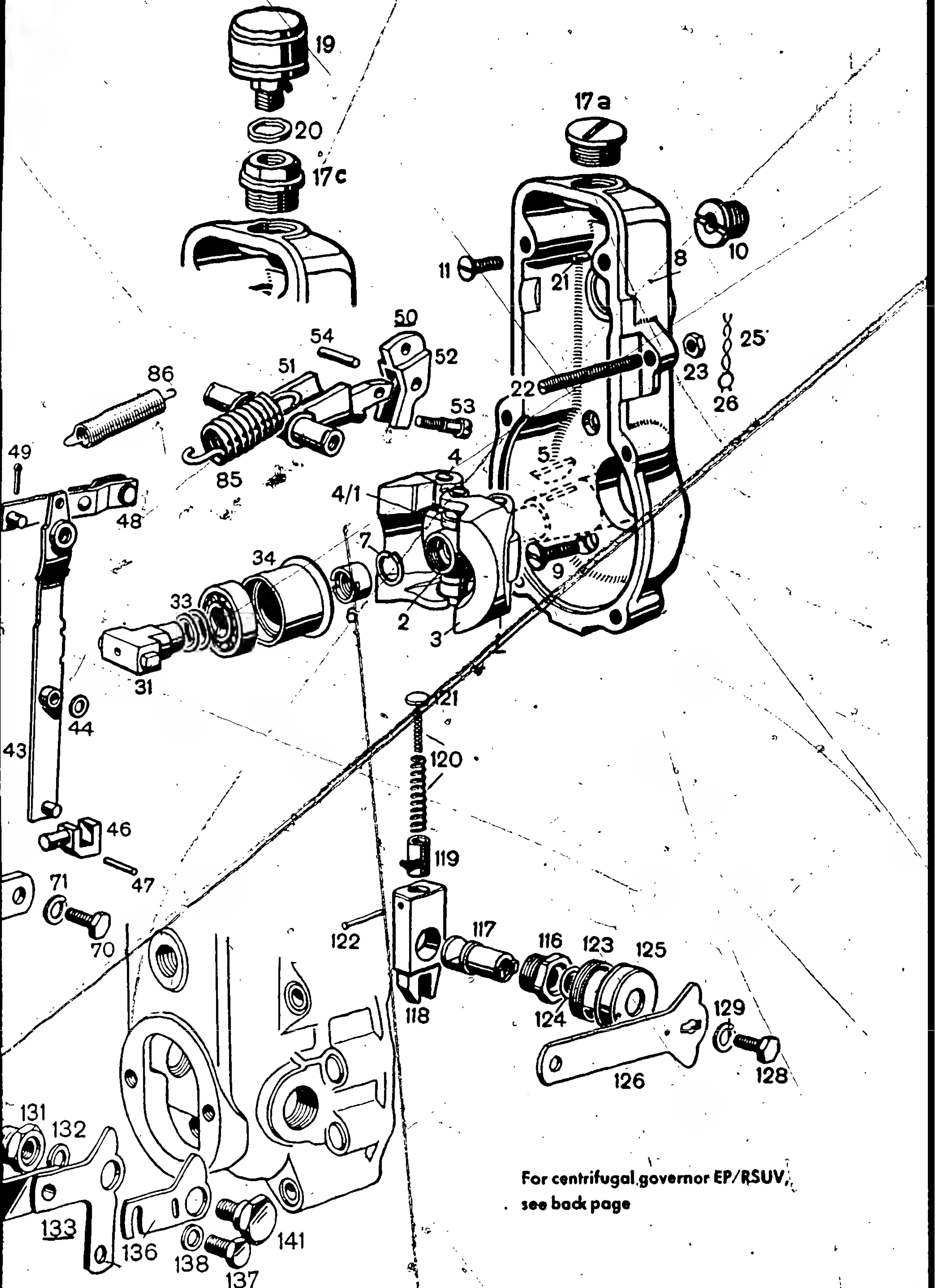

For centrifugal governor EP/RSUV, see back page

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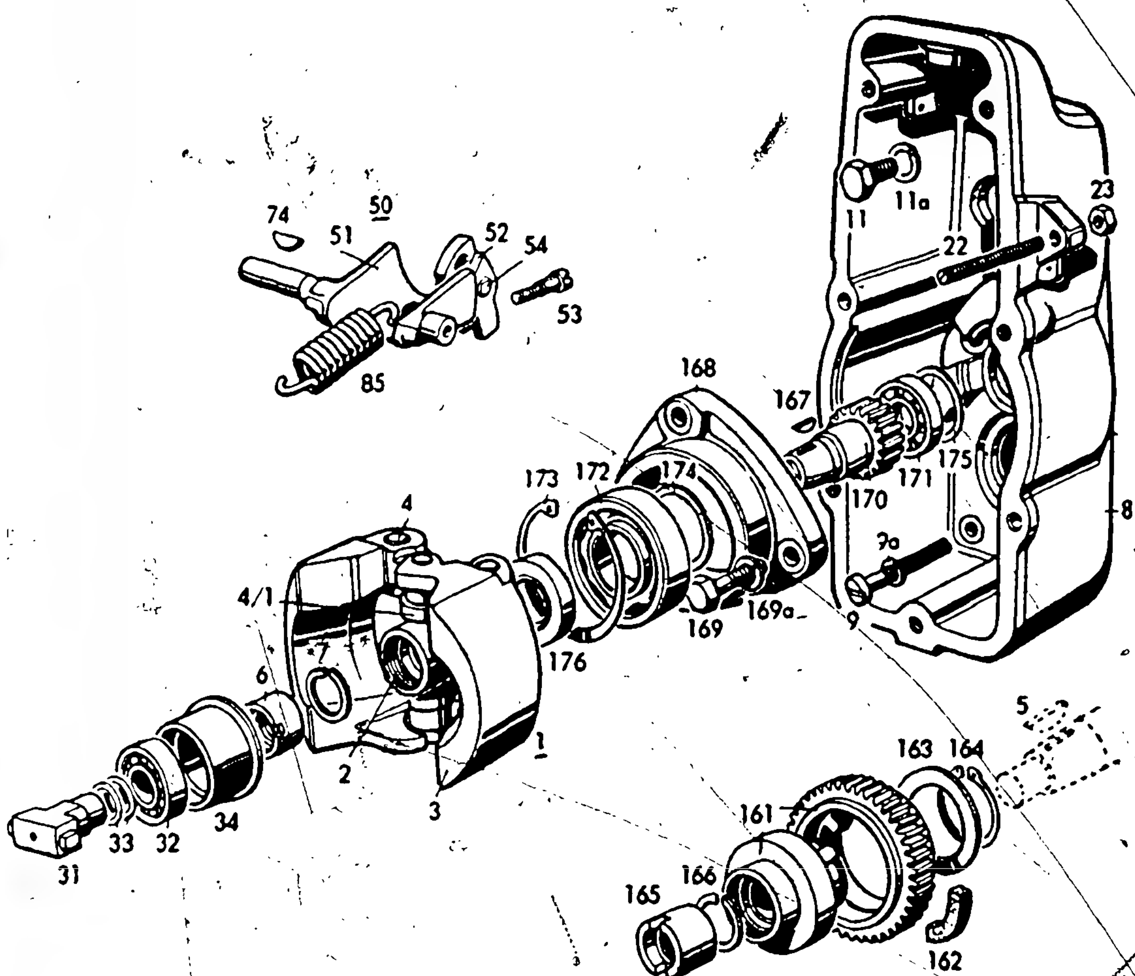
Centrifugal governor EP/RSUV



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After-sales Service Instructions

Repair

42
VDT-W-420/100 En
Suppl. 1
Ed. 2

Mechanical governors

0 420 081 . . – RW . . MW . .
with combined atmospheric and manifold-pressure compensator (ALDA)
or altitude pressure compensator (ADA)

BOSCH After-sales Service Automotive Equipment

C1

Contents

Automotive Equipment – After-sales Service
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(11. 78)

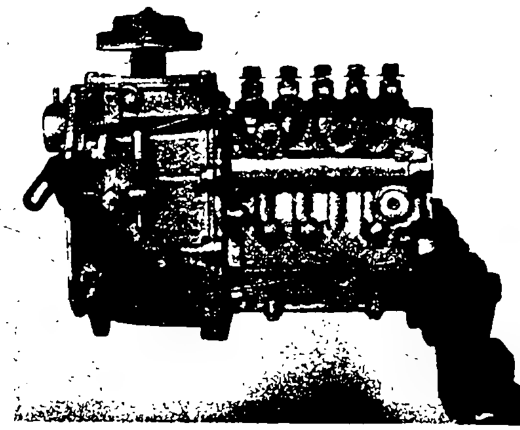
C2

1. Introduction

1.1 Design and operation

See publication VDT-I-403/2 En.
One must be familiar with this publication before repairs can be carried out correctly.
The operation of the control linkage for both ADA and ALDA is identical.

1.2 The position numbers occurring in the text, refer to the sectional drawing on Page 12 (fold-out)



1

2. Tools

Designation	Part No	Application
Clamping support	KDEP 2919	For clamping the fuel-injection pump and the governor
Clamping fixtures	KDEP 1067	For pumps with cradle mounting
Support clamp	KDEP 2963	For pumps with flange mounting
Flange	EFEP 157/6 1 685 720 018	PES with 3-hole flange
Flange	EFEP 157/4 1 685 720 017	PES with 4-hole flange
Ring	EFEP 29/0/3 1 680 202 005	Pilot dia. 68 mm
Pin wrench	KDEP 1062	For lock nut (Pos. 63)
Socket wrench	KDEP 1063	For stop (Pos. 70) and for locking
Pin wrench	KDEP 1064	For spring retainer (30) and for locking
Setting device	KDEP 1061	For sliding-sleeve (72) calibration
Dial indicator	EFAW 7 1 687 233 011	For setting device, effective measuring range 10 mm, graduations 1/100 mm
Measuring tool	KDEP 1070	For measuring the pin-projection dimension
Holding device	KDEP 1074	For compressing the spring (132)
Dial indicator	1 687 233 012	For measuring pin-projection dimension
Locking paste (Loctite)	Type CVV Commercially available	

3. Dismantling the governor

Mount the fuel-injection pump together with the governor on the test bench, using the clamping support KDEP 2919 and the appropriate clamping device.

Remove the cover (80) and the pneumatic shutoff device together with its gasket. Collect any fuel which escapes.

Unscrew the governor fastening screws (75) and the adjusting shaft (48)

2

Pull the governor housing back somewhat.

Disconnect the holding spring from the stud in the fulcrum lever (6).

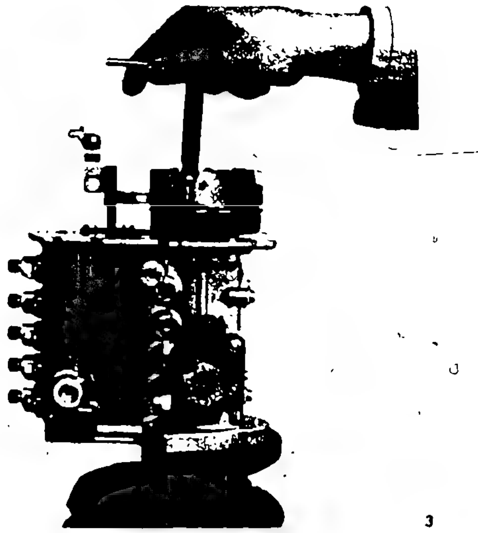
Pull the fulcrum-lever stud out of the control rod.

Remove the governor.

Unscrew the lock nut (63) using the pin wrench KDEP 1062.

Remove the flyweight carrier (64) together with the casing (58).

Remove the support disc (57) and the support piece (part of the injection pump) from the camshaft



3

Note:
Take care of the shims (141) and (133).
If one of these shims is lost, this will result in the start-of-adjustment of the aneroid box being changed The compression spring cannot be re-measured and calibrated

Pull off the shims (141) and (133), and the compression spring (132) from the stud

Remove the stop cover (52) and the gasket.

Release the tension on the extension spring (49 – governor spring) by unscrewing adjusting screw (28).

Move the tensioning lever (26) up against the retaining bracket (15), if necessary lift up the sliding sleeve.

Unhook the extension spring from the tensioning lever.

Pull the adjusting shaft (48) out of the housing, while at the same time unhooking the extension spring.

Remove the adjusting screw (28). Using the socket wrench, unscrew the stop (70).

Dismantle the flyweight assembly:

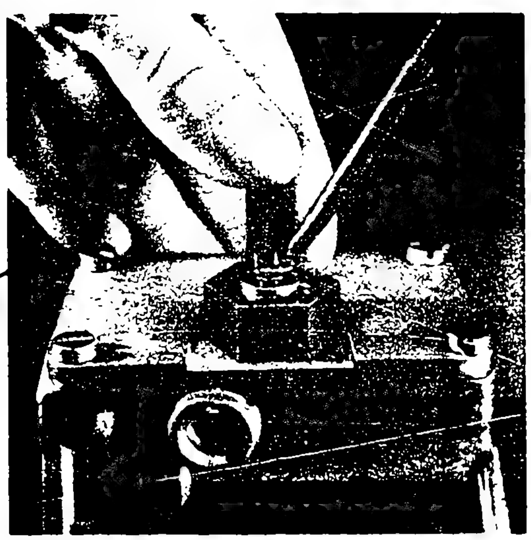
Fit a coupling half to the pump. Clamp the pump vertically in a vise using the coupling half.

Temporarily fit the flyweight assembly to the camshaft.

Remove the hexagon screws (68) and the holding bracket (67). Lift off the flyweights (65) together with the pivot pin (66) and the shims (84, 69)

Remove the lock nut (63).

Remove the flyweight carrier (64), the casing (58), and the driver disc (61) from the camshaft



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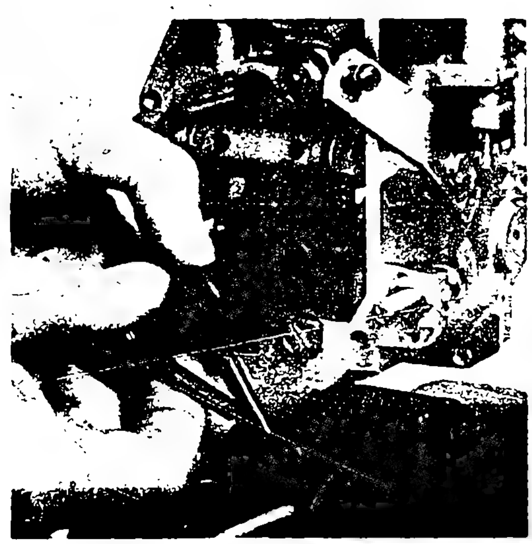

5

Using protective jaws, clamp the governor in a vise.

Loosen the union nut (52/2) on the aneroid box (147).

The hexagon nut (159) must NOT be loosened.

Pull the aneroid box (147) upwards and away from the stud of the governor link (120)

Remove the shims (148).

Push the holding device KDEP 1074 onto the stud.

During the following working step, lightly press against the locking washer with a finger in order to prevent it springing off

Lightly press on the holding device from above. Press out the locking washer with a screwdriver

Using the pin wrench KDEP 1064, remove the spring retainer (30).

Push the tensioning lever as far as it will go in the direction of the governor housing.

Remove the sliding sleeve (72), the needle-roller bearing (73), and the driver disc (74).

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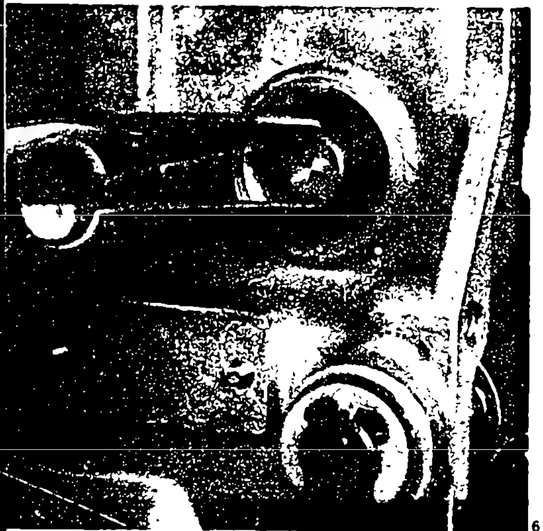


6

Heat the screw plug (36) lightly (approx. 120°C), taking care not to damage the aluminum housing, and screw it out. Pull out the bearing bolt (34) together with the retainer (35) (Fig 6)

Remove the tensioning lever and the shim (33).

Push out the leaf spring (32)

Remove the hexagon nut (43) together with the spring washer (47).

Pull the full-load stop (46) into the housing and then remove it.

7

Remove the lock washers (25), the spacer (24), and the plain washers (23).

During the next working step be sure that the clamping rings (14) and the shim (9) are not lost or damaged.

Pull the control lever (8) out of the housing.

Pull the clamping rings (14) and the driver (13) off of the control lever (8) one after the other.

Remove both screw plugs (7) Remove the swivel lever (2) together with the fulcrum lever (6) and the linkage lever (39) from the housing.

Turn the bar on the swivel lever and pull off the fulcrum lever.

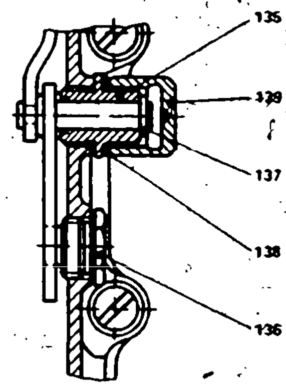
6

Remove the control lever (8):

Release the hexagon nut (21) and screw out the adjusting screw (81) (full-load stop)

Remove the hexagon nut (43) together with the spring lock washer (53) and the plain washer (41)

Remove the clamp screw (40) from the control lever (8). If necessary loosen the screw by means of light hammer blows.

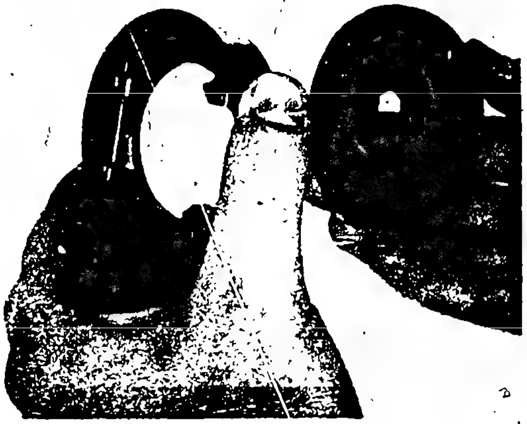


8

Remove the governor link (120)

Remove the cap nut (139) and the flat seal ring (138). Push the locking washer (134) off of the guide pin, and pull the governor link together with the guide pin out of the tube fitting (135). Screw out the tube fitting (135).

Remove the screw plug (136).



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3.1 Checking the individual parts for wear

Clean all the parts

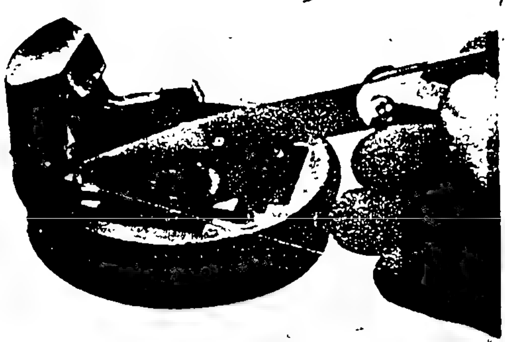
Replace any parts that have become worn or damaged.

As a basic principle, NEW gaskets, NEW seal rings (10), and NEW rubber buffers (60) must be fitted after any repair work has been carried out.

4. Reassemble the governor

4.1 Reassemble the flyweight assembly:

Lay the driver disc (61) on the driver (59). Press the lightly oiled rubber buffer (60) in by hand. Install this sub-assembly in the flyweight carrier (64).



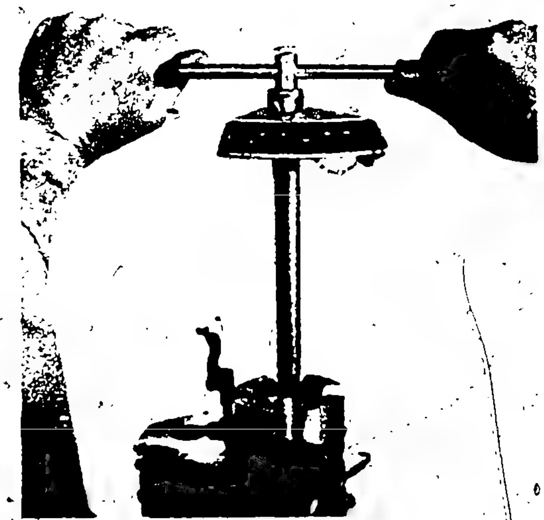
10

Lay the lock nut (63) on the driver.
Place the flyweights (65) in the flyweight carrier (64), together with pivot pin (66), and shims (84) on both sides.

Using a feeler gauge, measure the axial clearance of the flyweights. Set the clearance to 0.1 ... 0.2 mm using shims (69).

The shims are to be fitted on the opposite side to the flyweight arm.

With the aid of clamping bracket (67) and NEW hexagon screws, temporarily fit the flyweights (68).



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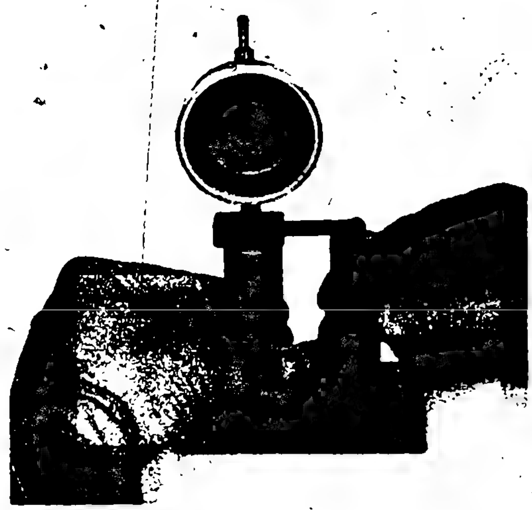
Clamp the injection pump vertically.

Slide the pre-assembled flyweight assembly onto the camshaft. Tighten the hexagon screws (68) with a torque of 10 ... 12 Nm (1.0 ... 1.2 kgf m).

Remove the flyweight assembly.

Slide the support piece (77) (hole dia. 25 mm – part of the injection pump), the support disc (57) (hole dia. 20 mm), the casing (58), and the pre-assembled flyweight assembly onto the camshaft.

Tighten the lock nut (63) using pin wrench KDEP 1062. Tightening torque 100 ... 110 Nm (10.0 ... 11.0 kgf m).



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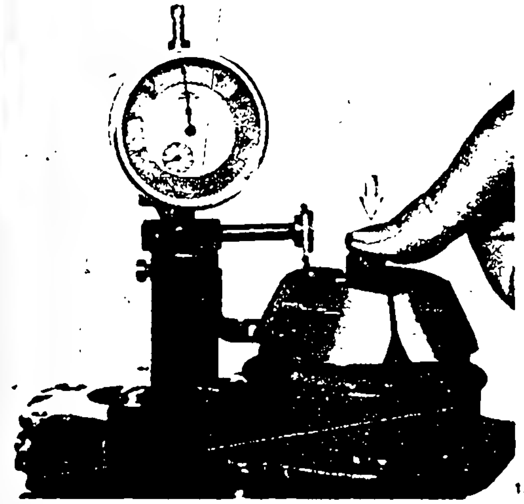
Sliding-sleeve calibration:

Calibrate the setting device KDEP 1061 against a standard gauge measure.

Pre-tension the dial indicator to a reading of 5 mm and set it to "0". Dial-indicator graduations: 1/100 mm

Using grease, stick the support disc (92), the needle-roller bearing (73), and the driver disc (74) onto the sliding sleeve (72).

Place the sliding sleeve onto the camshaft and press it down on the shaft.



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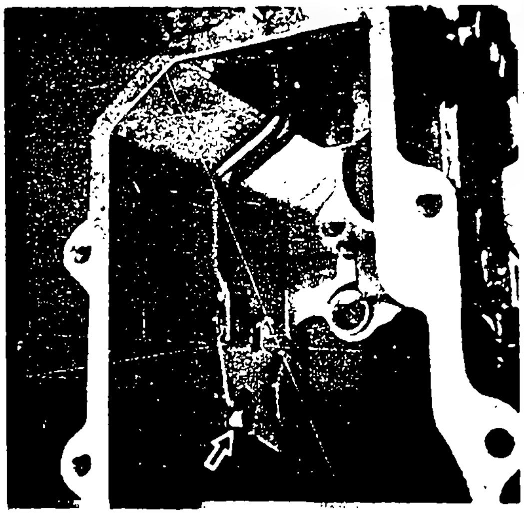


15

Insert the calibrated setting device into the "eye" of the sliding sleeve and bolt it in place

Using drive plates of various thicknesses (74), set deviation to "0" ± 0.1 mm

Remove the setting device KDEP 1061, sliding sleeve (72), drive disc(s) (74), needle-roller bearing (73), and the support disc (92)

Fit the governor parts in the housing:

Clamp the governor housing in a vise, using protective jaws if necessary

Fit the guide pin into the tube fitting (135).

Fit the lock washer (134)

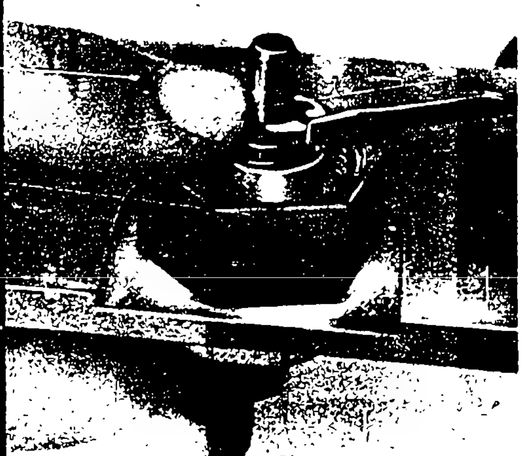
The screw plug (136) must be located in the recess of the governor-link template (arrow).

Fit the flat seal ring (138) and the cap nut (139).

Tighten the cap nut with a torque of 6 ... 8 Nm (0.6 ... 0.8 kgf m).

Screw-in the fillister-head screws (126) together with the spring lock washers (53).

Tighten the fillister-head screws with a torque of 4 ... 5 Nm (0.4 ... 0.5 kgf m).



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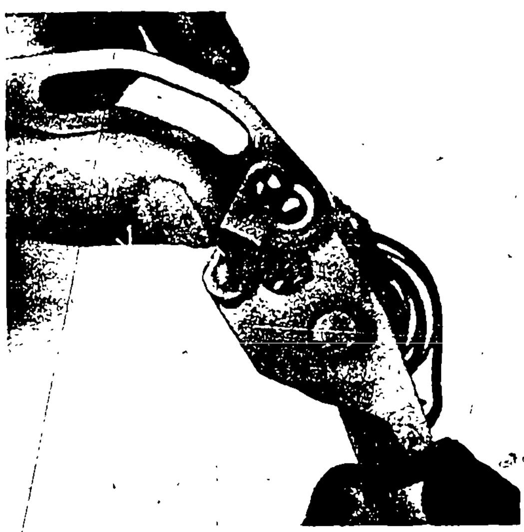

16

Guide the stud of the governor link (120), into the stop cover (52). Slide compression spring (132) and shims (141) (133), in that order, onto the governor-link stud

Press the compression spring and shims down by hand. At the same time, hold the governor link from underneath. Fit the lock washer (134).

Fit the tube fitting (135) and the screw plug (136), using new seal rings. Tighten the fitting and the screw plug with a torque of 6 .. 8 Nm (0.6 .. 0.8 kgf.m)

In the following working step, only the specified seal (51) is to be fitted.

Lay the seal on the governor housing, and fit the governor link together with the stop cover (52) into the governor housing.

Attach the fulcrum lever (6) to the swivel lever (2) and secure it with the bar.

Thoroughly degrease the screw plugs (7) (bearing screws for the swivel lever) and coat their threads with Loctite-CVV. Fit the swivel lever in the housing. Screw-in the screw plugs, and tighten with a torque of 20 .. 25 Nm (2.0 .. 2.5 kgf.m)

Check the swivel lever for ease of movement.

Fit new oil seals (10) in the bearing holes of the control lever (8)

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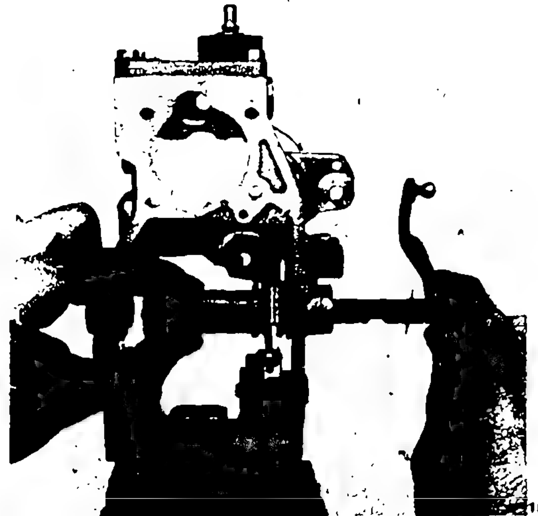

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Slide a plain washer (9) onto the control lever (8)

During the following working step, pay particular attention to the correct positioning of the linkage lever (39).

The pin with the smaller diameter is located in the governor-link template (120)

The pin with the larger diameter fits in the fulcrum lever (6)

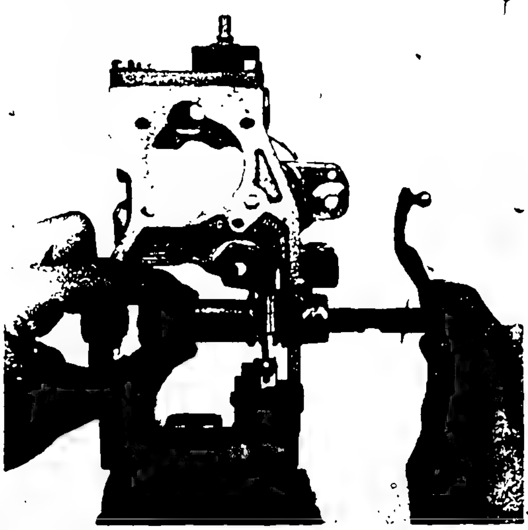
Fit spacer (24) and lock washer (25).

The control lever (8) must have no end play at all, it must though, be easy to rotate.

Correct by means of shims (23).

The driver (13) must be located in the pin of the swivel lever (2)

Secure the linkage lever (39) by means of the clamp screw (40) and the parts (41), (53) and (43).
The hexagon nut (43) must point upwards.



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The following order of the working steps applies to control levers which are inserted from the left (seen looking at the governor from the injection-pump side).

Slide the control lever (8) into the left-hand bearing bore of the housing. Fit the linkage lever (39), the clamping ring (14), the driver (13), and the second clamping ring (14), in this order, onto the control lever Now push the end of the control lever through the bearing bore in the opposite side of the housing

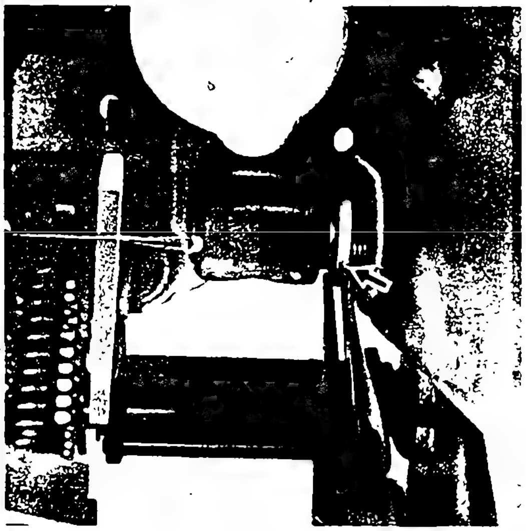
A lock washer (25) must be inserted between both the linkage lever (39) and the clamping ring (14), as well as between the governor housing and the clamping ring (14) on the right-hand side of the governor

Fit the full-load stop (46) in the threaded bushing (44).

The sensing finger (part of the full-load stop) now contacts the curved track in the driver (13).

The tongue of the full-load stop must fit in the pin in the housing

Hook the leaf spring (32) into the tensioning lever (26). The curved ends must point away from the pump



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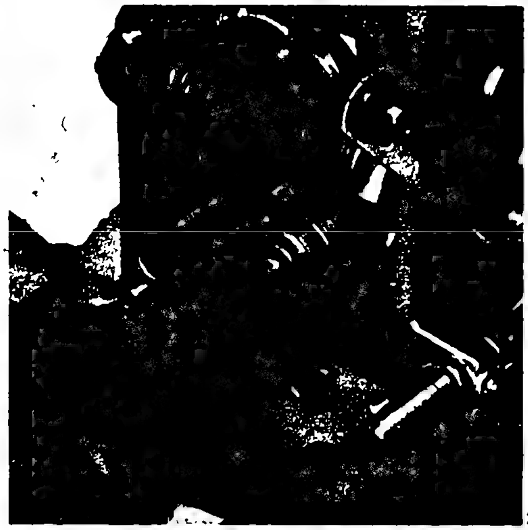

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Using grease, stick the shim (33) into the governor housing

During the following working step, ensure that the tensioning lever (26) is located in the retaining bracket (15).

Fit the tensioning lever (26) in the housing. Slide in the bearing pin (34) together with the retainer (35)

Coat the screw plug (36) with Loctite CVV and screw it into place.

Push the tensioning lever (26) as far as it will go in the direction of the governor housing

Fit the sliding sleeve (72), together with the support disc (92), needle-roller bearing (73), and **previously selected** drive plate (74), onto the ball head of the swivel lever (2)

Fit the governor to the injection pump:

Center the sliding sleeve (72) to the camshaft by inserting a user-fabricated guide pin (see Section 6) through the hole in the spring retainer (30)

Push the lower edge of the governor up against the pump

Note:
Before suspending the fulcrum lever (6) in the control lever, the inner full-load stop (46) must be suspended from the stud of the control rod

During the following working step, pay particular attention to ensuring that excessive sideways pressure is not applied to the control rod Otherwise, the control rod will seize

Suspend the fulcrum lever (6) in the control rod. Clip the holding ring into place on the fulcrum lever

21

21

Slide the adjusting shaft (48) a slight distance into the housing. Hook the extension spring (49) into the groove in the adjusting shaft

Now push the adjusting shaft (48) all the way in.

Push the tensioning lever (26) up against the retaining bracket (15), if necessary, lift up the sliding sleeve

Hook the extension spring into the tensioning lever (26)

Temporarily screw the adjustment screws (28), the spring retainer (30), and the stop piece (70) into the tensioning lever (26).

Fit the hexagon bolt (19) and the full-load stop (81).

Secure the injection pump to the clamping support.

Using grease, stick the gasket (76) to the pump housing

Now push the governor fully up against the injection-pump housing Fit the fastening screws (75) and tighten them with a torque of 5 .. 7 Nm (0.5 ... 0.7 kgf m). Screw-in the adjusting shaft (48) and tighten it with a torque of 15 ... 20 Nm (1.5 ... 2.0 kgf.m).

Fit the cover (80) together with its gasket (79).

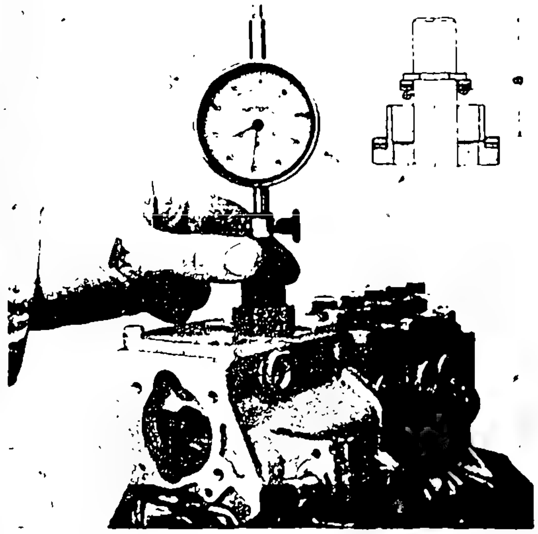
Screw the fastening screws (54) (55), together with retainer rings (53), into place and tighten with a torque of 4 ... 5 Nm (0.4 .. 0.5 kgf.m).

Measure the pin-projection dimension:

Clamp the dial indicator 1 687 233 012, together with shaft, into the measuring tool KDEP 1070

Set up the measuring tool on a level surface (surface plate, test-bench bed)

Pre-tension the dial indicator to about 1 mm and set it to "0."



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a = pin-projection dimension.

Insert the shims (148)

Set up the measuring tool, together with the dial indicator, on the shims (148).

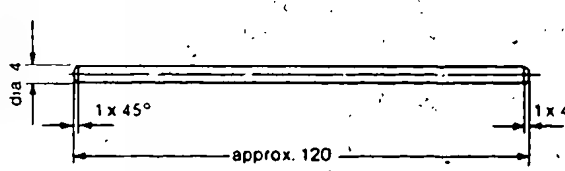
Read off the pin-projection dimension on the dial indicator and compare the reading with the required figures given in the Test Specifications Sheet.

Correct by the use of shims (148).

Remove the shims because the first stage of the testing takes place without the aneroid box.

Test and adjust the governor in accordance with VDT-W-420/300 En, Suppl 2

5. Auxiliary tool



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6. Tightening torques

Item No	Designation	Nm	kgf m
7	Screw plug	20 ... 25	2.0 ... 2.5
16	Flat-head screw	6 ... 8	0.6 ... 0.8
36	Screw plug	25 ... 30	2.5 ... 3.0
43	Hexagon nut for item 40	6 ... 7	0.6 ... 0.7
43	Hexagon nut	7 ... 9	0.7 ... 0.9
45	Hexagon nut	20 ... 23	2.0 ... 2.3
48	Adjusting shaft	15 ... 20	1.5 ... 2.0
50	Screw plug	8 ... 9	0.8 ... 0.9
54	Fillister-head screw	4 ... 5	0.4 ... 0.5
63	Lock nut	100 ... 110	10.0 ... 11.0
68	Hexagon screw	10 ... 12	1.0 ... 1.2
75	Fillister-head screw	5 ... 7	0.5 ... 0.7
135	Tube fitting	6 ... 8	0.6 ... 0.8
136	Screw plug	6 ... 8	0.6 ... 0.8
143	Screw plug	25 ... 30	2.5 ... 3.0

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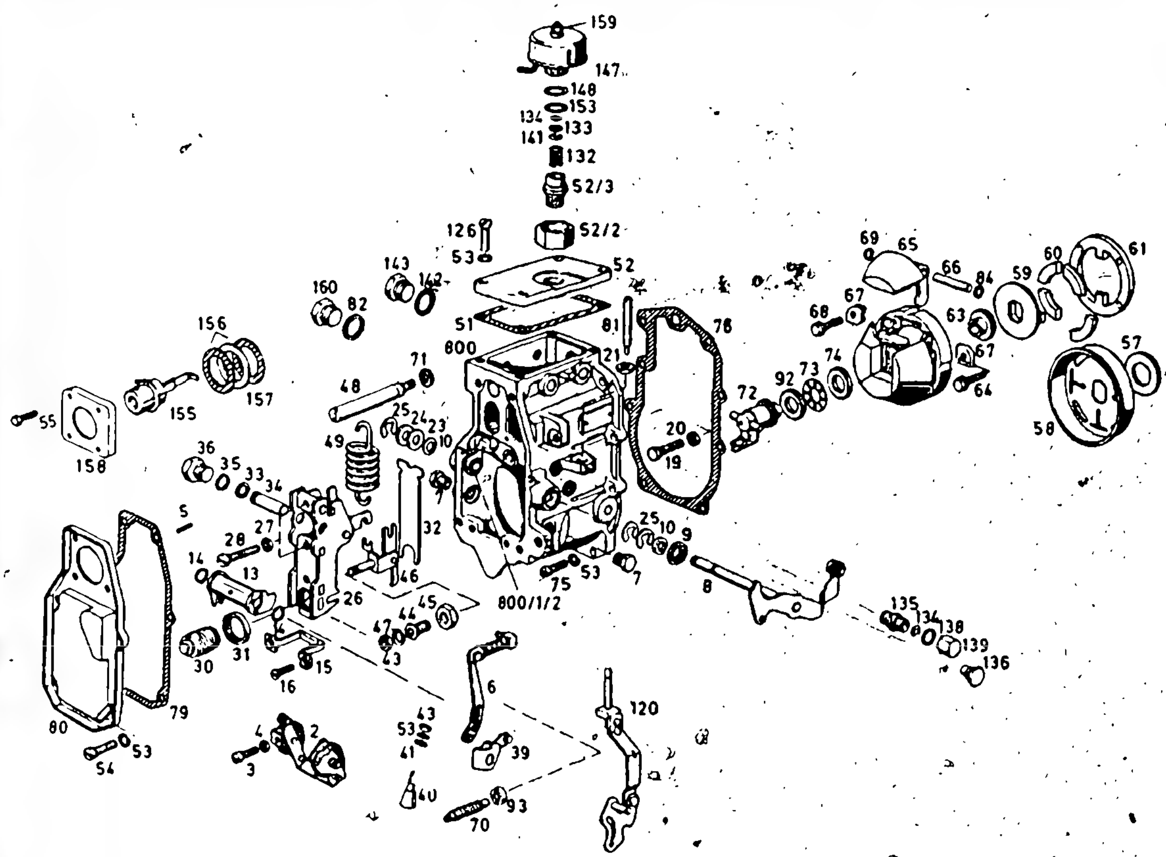

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After-sales Service Instructions

Repair

42

VDT-W-420/100 En
Suppl. 2
Ed. 1

Mechanical governors

0 420 081 . . -RW . . MW . .
with port-closing sensor system (FBG)

BOSCH After-sales Service Automotive Equipment

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C 11

This publication has been redesigned with the forthcoming change-over to microfilm in mind. When a publication has been transferred to microfilm, the screen will be filled completely by a quarter of a printed-publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference is constantly being made to a particular illustration.
Until the change-over to microfilm we have slightly reduced the size of the print and of the illustrations.

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3

1. Introduction

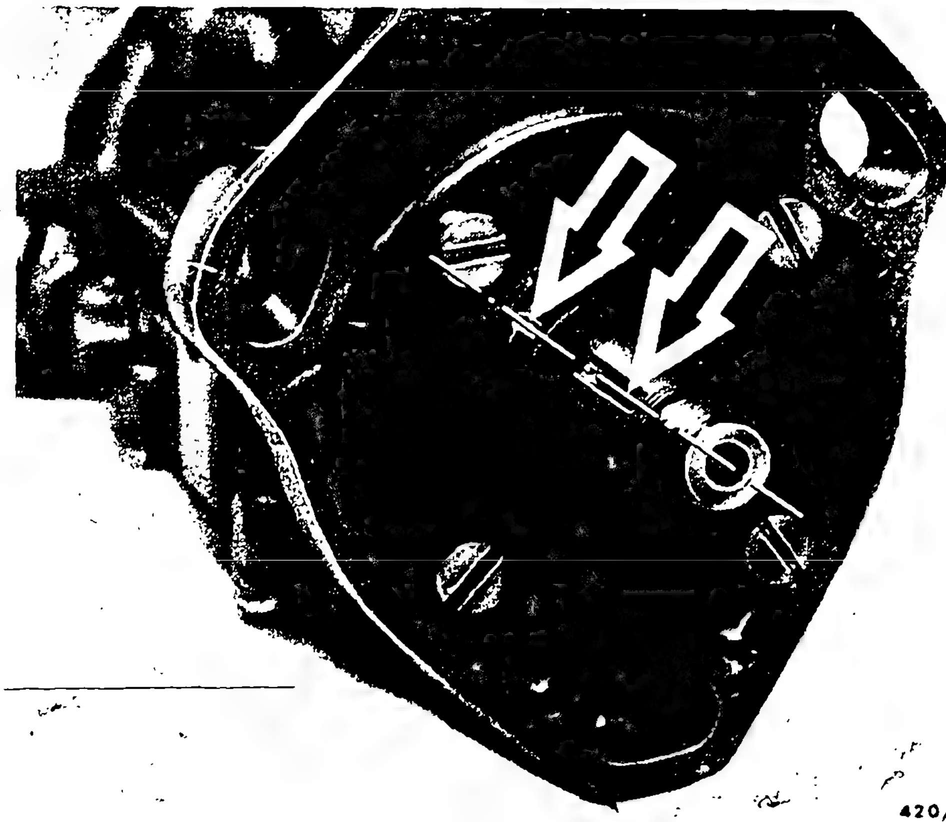
The construction and operation of these governors is described in Motor Vehicle Service Information VDT-I-413/1 (4.83).

2. Repair

These governors are dismantled and assembled in accordance with Repair Instructions VDT-W-420/100 - Ed. 1 - up to and including page 4 - (remove flyweight assembly - next to Fig. 9).

Note:

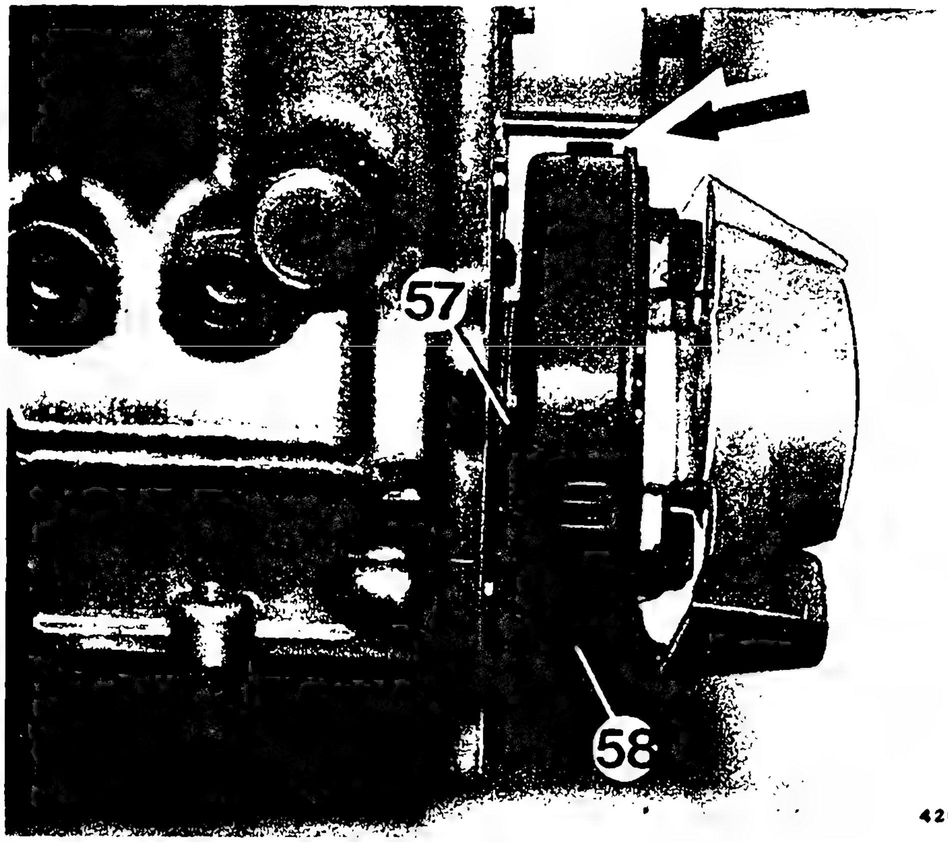
To loosen the fastening screws on the sliding flange, a slit must be sawn into the screw heads.



420/0030

2.1 Different operations for governors with FBG system

Turn the camshaft of the injection pump until the Woodruff key groove on the camshaft aligns with the line marking on the pump flange.



Slip the assembled flyweight part onto the camshaft with supporting plate (bore dia. 25 mm, part of the injection pump), support disc (57) bore dia. 20 mm, capsule (58) with the angle mark toward the control rod.

Tighten the lock nut (Item 63) to the specified tightening torque (100...110 Nm) using pin wrench KDEP 1062.

For the following operations, see Repair Instructions VDT-W-420/100 - Ed. 1 - starting on page 5 "Measure the sliding sleeve...".

BOSCH

REPAIR INSTRUCTIONS
42
VDT-WJP 211/7 B
<VDT-W-420/100 B>
Ed. 1

Mechanical Governors

0 420 081 . . – RW . .   MW . .
0 420 093 . . – RWV . . MW . .

C19

C19

W-420/100

Contents

Page

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Queries and comments concerning the contents of this publication are to be addressed to our representative in your country.

1. Introduction

This instruction booklet describes the disassembly, repair, and assembly of BOSCH Mechanical Governor RW (V) .. MW .. .

The construction and operation of these governors are described in Technical Instruction Publication VDT-BEP 102/1 (≤VDT-J-403/1 B >).

We recommend that you read the publication before carrying out repairs on a governor of the type specified using this instruction booklet.

Some special tools are required for the repair work described here and are listed in Section 2 below.

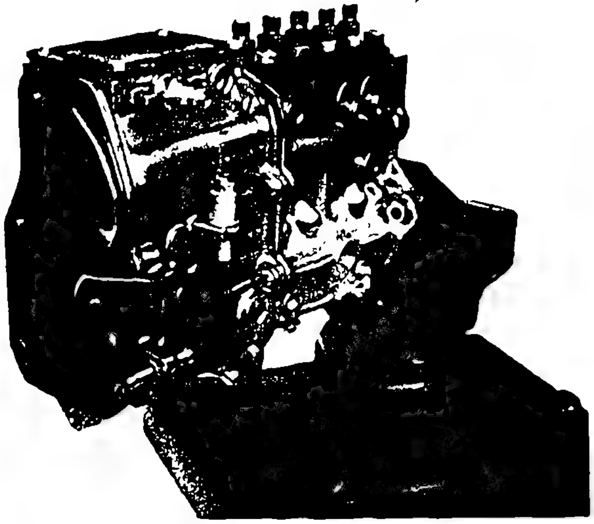
The numbers given in parentheses in the text refer to parts shown in the sectional views of the governor given on Page 8 (fold-out).

2. Special Tools

Tool	Type Designation and Part No.	Application
Mounting device	KDEP 2919 (EF 8498 C)	For mounting the fuel injection pump complete with governor
Mounting parts	KDEP 1067 —	For fuel injection pump with cradle mounting
Clamp	KDEP 2963 —	For fuel injection pump with flange mounting
Flange	EFEP 157/6 1 685 720 018	PES .. with 3-hole flange
Flange	EFEP 157/4 1 685 720 017	PES .. with 4-hole flange
with ring	EFEP 29/0/3 1 680 202 005	Pilot diameter 68 mm
Pin wrench	KDEP 1062 —	For lock nut (63)
Socket wrench	KDEP 1063 —	For stop piece (70) and for tightening lock nuts
Pin wrench	KDEP 1064 —	For spring retainer (30) and for tightening lock nuts
Setting device	KDEP 1061 —	For adjusting the sliding sleeve (72)
Dial indicator	EFAW 7 1 687 233 011	For use with the setting device, measurement range 10 mm, graduations 1/100 mm

x2

3. Disassembly

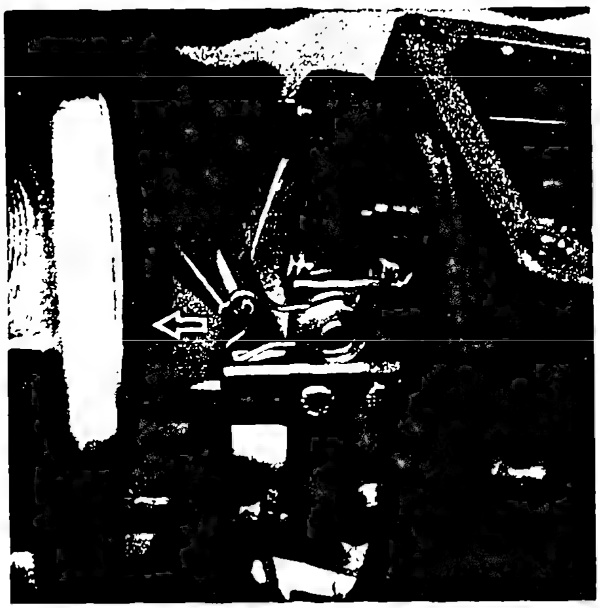


1

Fasten the fuel injection pump together with the governor to mounting device KDEP 2919 using the proper mounting parts (see Section 2, "Special Tools" above).

Remove the two covers (52 and 80), together with their gaskets. Collect the oil that flows out.

Remove the fixing screws (75) holding the governor in place.

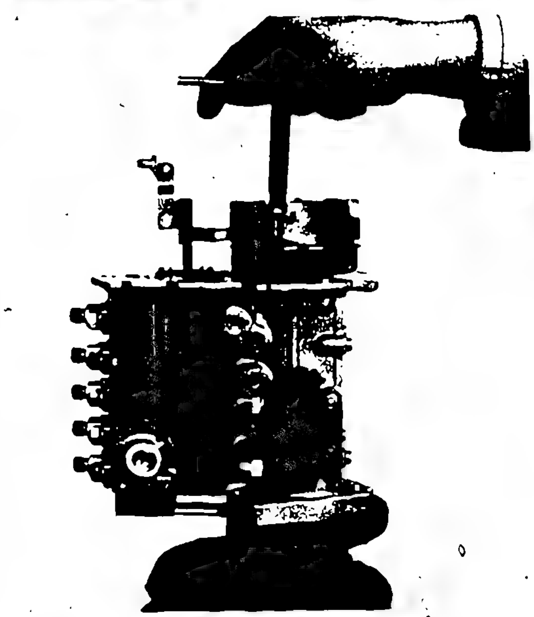


2

Pull the governor housing back somewhat.
Detach the fulcrum lever (6) from the control rod – to do this, remove the holding spring with pointed pliers.
Remove the governor.

Remove the flyweight assembly – to do this unscrew the lock nut (63) using pin wrench KDEP 1062 and remove the flyweight carrier (64) together with the flyweights (65) and the casing (58).

Remove the support disc (57) and the support piece (part of the fuel injection pump) from the camshaft.



3

Dismantle the flyweight assembly:

Clamp the fuel injection pump vertically in a vise. Set the flyweight assembly on the camshaft. Unscrew the 4 hexagon bolts (68) and the clamping jaws (67). Lift off the flyweights (65) together with the pivot pin (66) and the shims (84, 69).

Remove the lock nut (63), the flyweight carrier (64), and the casing (58) together with the drive plate (61) from the camshaft.

Clamp the governor in a vise using protective jaws.

Release the tension on the extension spring (49) by unscrewing the adjustment screw (28).
Unscrew the tapered screw plug (50) from the adjusting shaft (48).
Remove the adjusting shaft (48) from the housing.
Detach the extension spring from the tensioning lever (26).
Release the tension on the leaf spring (32) in the tensioning lever (26) – to do this unscrew the adjustment screws (29) and the stop (70) using the pin wrench and socket wrench KDEP 1063.

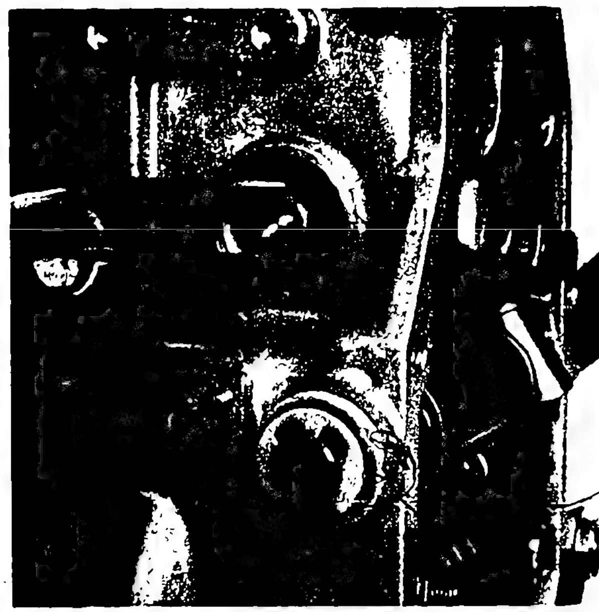
Remove the spring retainer (30) from Governor RW (or the driver screw (30) from Governor RWV, as the case may be) using pin wrench KDEP 1064 or a 1/2" hexagon socket screw key.

Remove the sliding sleeve (72), the needle roller bearing (73) and the drive plate (74).

4

Remove the tensioning lever (26) together with the leaf spring (32) – to do this, remove the screw plug (36), pull out the bearing bolt (34) together with the retainer (35) and remove the tensioning lever together with the shim (33)..

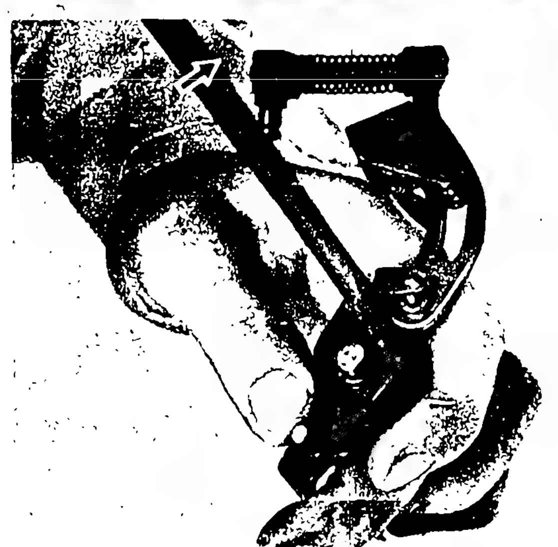
Slide the leaf spring (32) out.
Remove the full-load stop (46) – to do this first remove the hexagon nut (43) together with the spring washer (47).



5

Remove the control lever (8):

Release the hexagon nut (20) and unscrew the adjustment screw (81) (idle stop).
Remove the clamping bolt (40) at the fulcrum lever (6) – to do this, remove the hexagon nut (43) together with the lock washer (53) and the plain washer (41).
Remove the clamping screw by tapping it lightly with a hammer.
Remove the lock washers (25), the spacer (24), and the plain washers (23).
When pulling the control lever (8) out, be sure that the clamping rings (14) and the washer (9) are not damaged or lost.
Remove the driver (13).

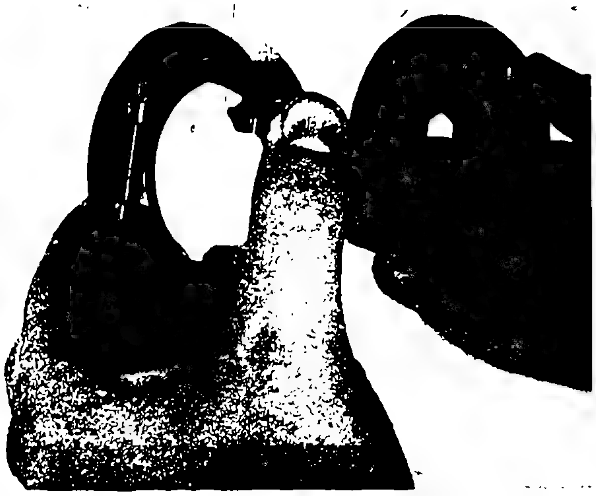


Remove the swivel lever (2) together with the fulcrum lever (6) – to do this, unscrew both of the screw plugs (7). Turn the bar at the swivel lever and pull the fulcrum lever off.

6

4. Checking the Parts

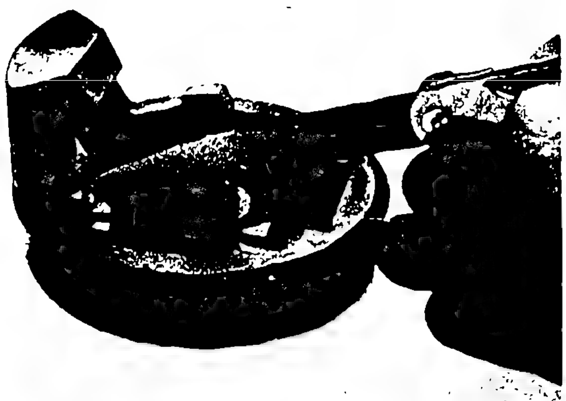
Clean all of the individual parts.
Replace any parts that have become worn or damaged.
As a basic principle, after any repair work reassemble using new gaskets, sealing rings (10), and rubber buffers (60).



5. Assembly

Before assembly, coat all moving parts with test oil.
All screws and bolts must be tightened with the torques specified in Section 7.

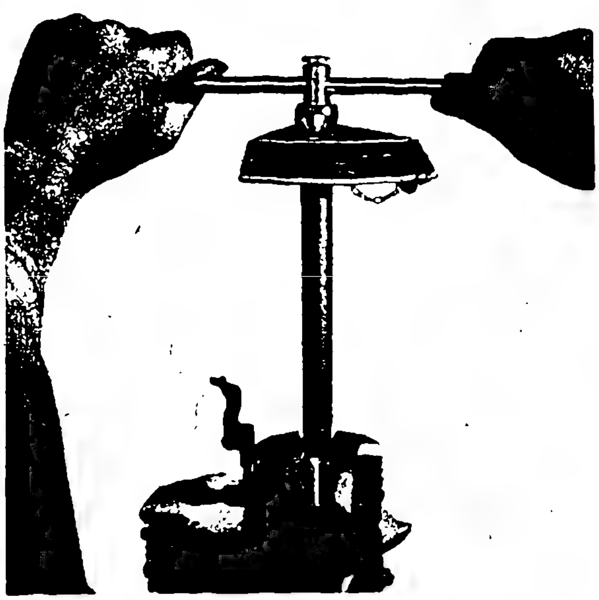
7 Reassemble the flyweight assembly:
Lay the drive plate (61) on the driver (59) and press in the rubber buffer (60) (coated with oil) by hand.
Install this sub-assembly in the flyweight carrier (64).



Place the lock nut (63) on the driver.
Place the flyweights (65) in the flyweight carrier (64), together with pivot pin (66) and shims (84) on both sides.

Measure the axial play of the flyweights with a feeler gauge and set this play to 0.1 – 0.2 mm with shims (69). The thickness of the shims should be about the same on both sides.

8 Fasten the flyweights in place with the clamping jaws (67) and with new hexagon bolts (68).



In order to tighten the hexagon bolts (68), place the pre-assembled flyweight assembly on the camshaft holding the fuel injection pump vertically for this purpose.

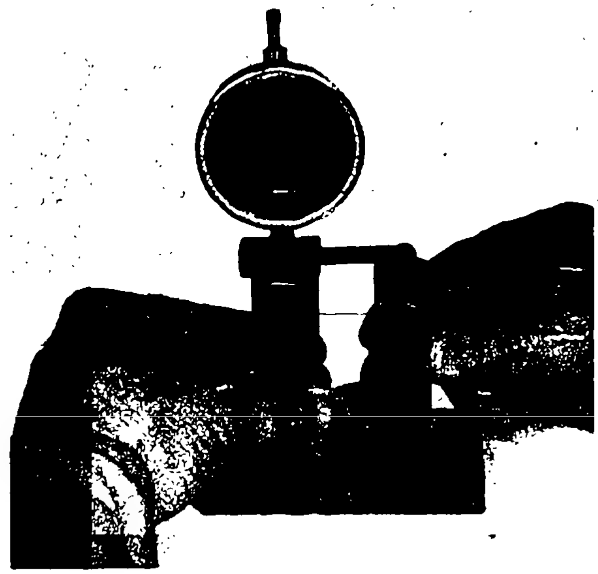
Remove the flyweight assembly.

Mount the flyweight assembly on the camshaft – for this purpose slide the support disc (77) (hole diameter 25) (part of the fuel injection pump), the support piece (57) (hole diameter 20), the casing (58), and the pre-assembled flyweight assembly onto the camshaft.

9 Tighten the lock nut (63) using pin wrench KDEP 1062 with the torque specified.

Measure sliding sleeve travel:
Adjust setting device KDEP 1061 with a calibrated measure.

Pre-tension the dial indicator (which is in graduations of 1/100 mm) to a reading of 5 mm and set it to "0".

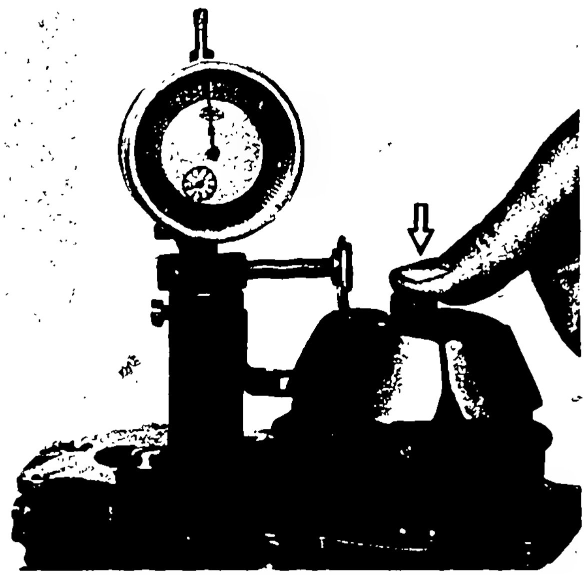


10

Glue, with grease, the needle roller bearing (73) and the drive plate (74) to the sliding sleeve (72).
Place the sliding sleeve on the camshaft and press it onto the shaft.

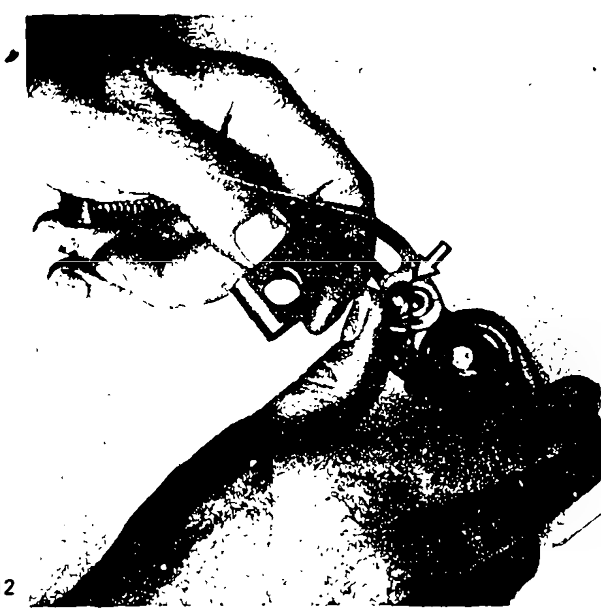
Insert the calibrated setting device into the eye of the sliding sleeve and bolt it in place.

Set any deviation to "0" ± 0.1 mm by installing drive plates of the thicknesses required.



11

Install the governor parts in the housing:
Attach the fulcrum lever (6) to the swivel lever (2) and fasten it with the bar.



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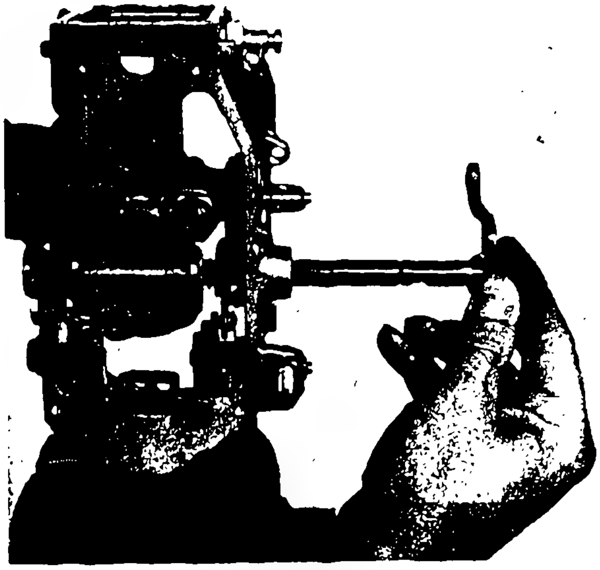


13

Clamp the pump housing in a vise, using protective jaws. Install the swivel lever in the housing.

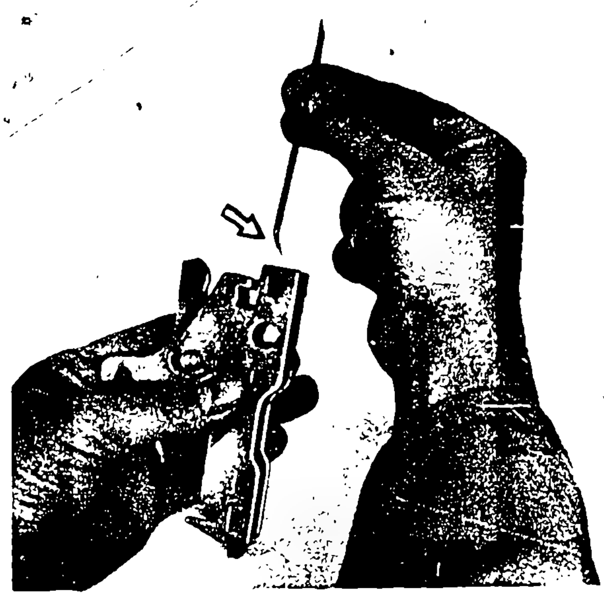
Coat the threads of the screw plugs (7) (bearing bolts) with Loctite-CVV, screw these plugs into place and tighten them. Check the swivel lever for easy movement.

Install the driver (13) and the control lever (8): Slide the washer (9) (0.5 mm thick) onto the control lever shaft.
Then slide the control lever shaft through the right-hand bearing hole in the housing and through the fulcrum lever (6), the clamping ring (14), the driver (13), the other clamping ring (14), and through the left-hand bearing hole. (This applies to control levers which are pushed in from the left. Seen looking onto the governor drive end).

In the RWV governor, the fulcrum lever (6) must also be suspended in the curved track in the guide sleeve attached to the housing. Then a retainer (25) is placed between the fulcrum lever (6) and the clamping ring (14) and another retainer is placed between the governor housing and the clamping ring (14).

Mount the spacer (24) and the retainer (25). Adjust the control lever (8) with washers (23) so that it has no play and check that it moves freely. Fasten the fulcrum lever (6) with the clamping screw (40) and parts (41), (53), and (43).
The hexagon nut must point upward here.

Install the full-load stop (46 full-load limit) in the threaded bushing (44) so that the follower lever lies against the curved track in the driver (13). Insert the bar into the bolt.



14 Suspend the leaf spring (32) in the tensioning lever (26).

97

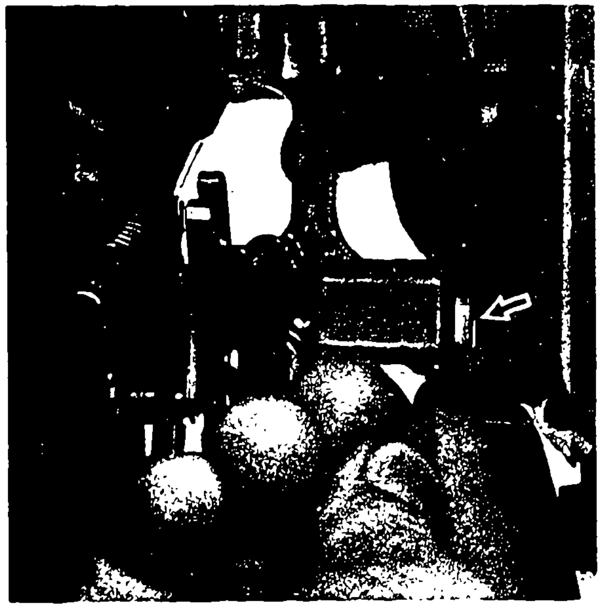
Glue the shim (33) into the housing with grease. Install the tensioning lever in the housing and slide the bearing bolt (34) with the retainer (35) in. Be sure that the tensioning lever is inserted in the retaining bracket (15).

Coat the screw plug (36) with Loctite-CVV and screw it into place.

Place the sliding sleeve (72) with the needle roller bearing (73) and the **previously-selected drive plate** (74), on the spherical end of the swivel lever (2).

Suspend the extension spring (49) in the spring retainer in the tensioning lever (26), and slide the adjusting shaft (48) through the eye of the extension spring until it reaches the housing stop. Screw the tapered screw plug (50) into the adjusting shaft.

Screw the adjustment screws (28), (29), the spring retainer (30), and the stop piece (70) temporarily into the tensioning lever (26).



15

Fasten the fuel injection pump on the mounting device.

Glue the gasket (76) to the housing of the fuel injection pump with grease.

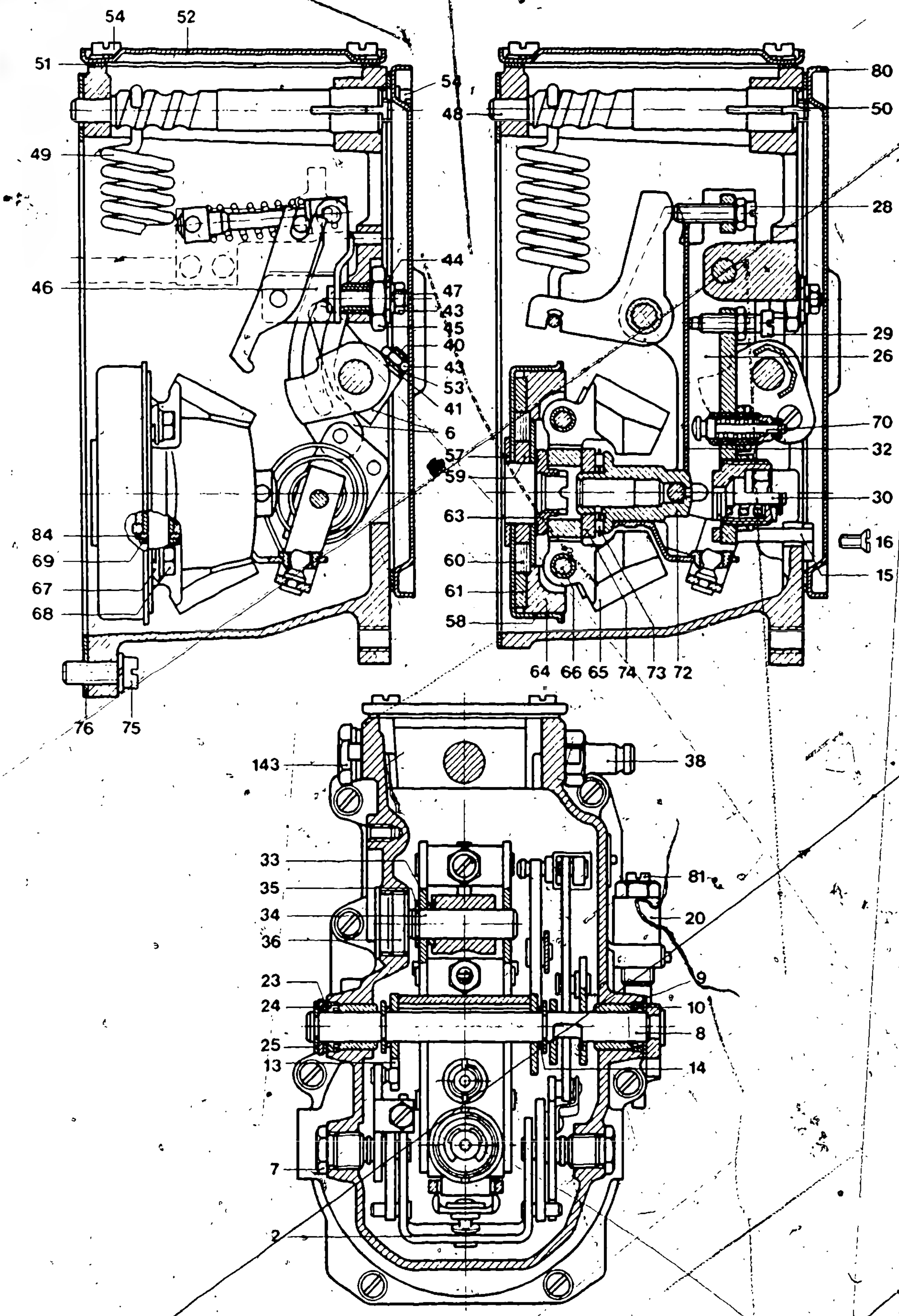
Mount the governor on the fuel injection pump – to do this, center the sliding sleeve (72) by inserting a home-made guide pin (see Section 6, Fig. 18) through the hole in the spring retainer (30) to the camshaft.

16

Suspend the fulcrum lever (6) in the control rod and lock the holding spring into the fulcrum lever.
Install the full-load stop (46) follower lever and bolt the governor to the injection pump.
Screw the adjustment screw (81) (idle stop) with the hexagon nut (20) into the governor housing.
Mount the covers (52 and 80) together with gaskets.

Check and adjust the governor according to Test Instructions VDT-WPP 211/... .

17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6. Auxiliary Tools

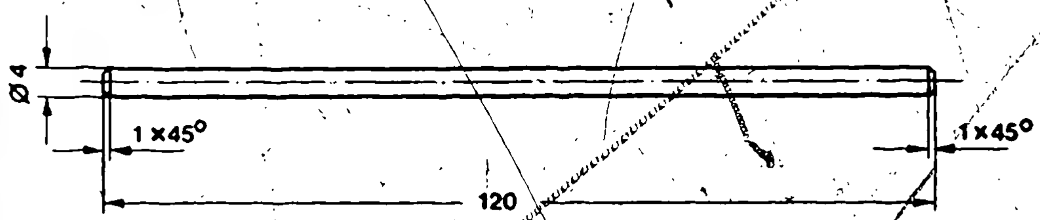


Fig. 18

7. Tightening Torques

Pos. No.	Designation	Nm	kgf.m
7	Screw plug	20– 25	2 – 2.5
16	Flat head screw	6– 8	0.6– 0.8
36	Screw plug	25– 30	2.5– 3.0
38	Connector bolt	25– 30	2.5– 3.0
43	Hexagon nut for Pos. No. 40	6– 7	0.6– 0.7
43	Hexagon nut	7– 9	0.7– 0.9
45	Hexagon nut	20– 23	2.0– 2.3
50	Screw plug	8– 9	0.8– 0.9
54	Fillister head screw	4– 5	0.4– 0.5
63	Lock nut	100–110	10 –11
68	Hexagon screw	10– 12	1 – 1.2
75	Fillister head screw	5– 7	0.5– 0.7
143	Screw plug	25– 30	2.5– 3.0

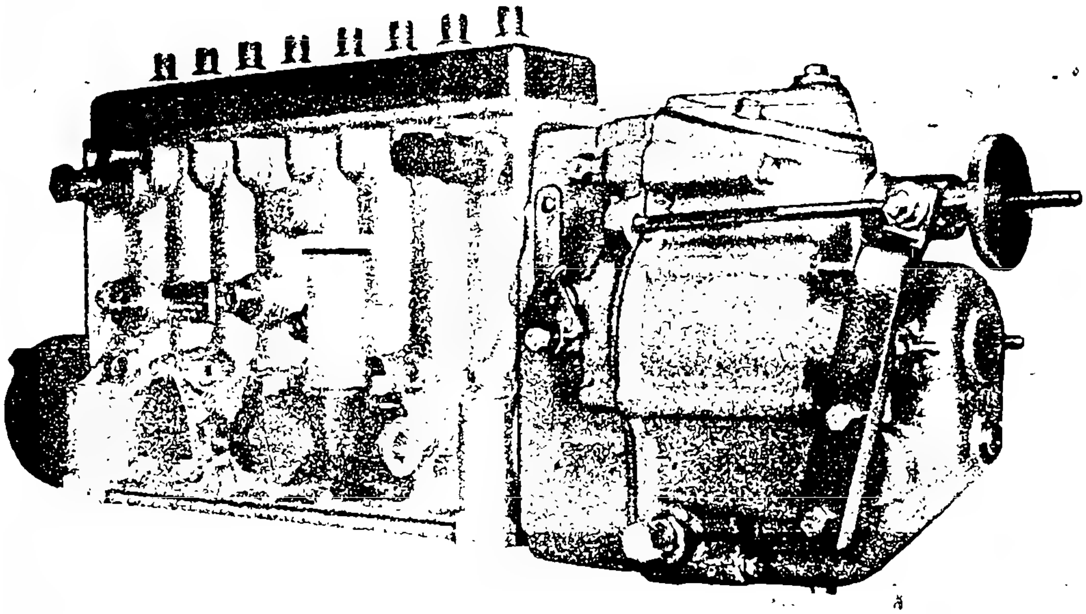
C28

BOSCH

REPAIR INSTRUCTIONS
INSTRUCTIONS DE REPARATION
INSTRUCCIONES DE REPARACION

EP

VDT-WJP 211/6 B
Ed. 8.70



Mechanical Governor
Régulateurs centrifuges
Reguladores centrifugos

EP/RZU . . A . . **0 420 26 . . . .**
EP/RZU . . P . . **0 421 86 . . . .**

D1

D1 ~~C.. E.. G.. G.. H..~~

1. Introduction

These instructions describe the disassembly and repair of individual assemblies and reassembly of the BOSCH governor EP/RZU..A.. and ..P..

The governor versions, models A and P, are basically identical in design. They differ only in a few mounting components for the installation of the two different pump models A and P.

Several replacement components, such as the governor spring set and the flyweight assembly differ as a function of the various governor designs. Consequently, particular care must be taken that only those replacement parts specified in the service parts list for a specific design will be used.

A few special tools are necessary for these repairs; they are listed in the summary below (Item 2).
Furthermore, a few auxiliary tools are needed which can be made easily in the shop by following the sketches on p. 22 (Item 9) (machined parts).

1. Introduction

Le présent imprimé décrit les opérations de démontage, de réparation et de remontage des différents ensembles constitutifs des régulateurs de vitesse Bosch EP/RZU.. A ... et EP/RZU.. P...

Les exécutions des tailles A et P sont de structure identique. Seuls diffèrent quelques éléments de jonction pour le montage des régulateurs sur les deux modèles de pompes A et P.

Diverses unités, telles que le jeu de ressorts de régulation et le bloc-régulateur, varient en fonction de la conception des régulateurs. C'est pourquoi il est impératif, en cas de remplacement, d'utiliser uniquement les pièces prescrites dans la liste des pièces de rechange correspondant à l'exécution considérée.

La réparation exige l'emploi de quelques outils spéciaux dont la liste est donnée dans le tableau ci-contre (chapitre 2).
De plus, il faut également avoir recours à quelques outils auxiliaires (pièces tournées) aisément réalisables suivant les croquis de la page 22 (chapitre 9).

1. Introducción

Estas instrucciones describen el desmontaje, la reparación de los diversos grupos constructivos y el montaje de los reguladores del número de revoluciones Bosch EP/RZU.. A... y P...

Las ejecuciones de regulador de los tamaños A y P son esencialmente iguales en su estructura. Se diferencian únicamente en algunas piezas de conexión para el acoplamiento a bombas de los dos distintos tamaños A y P.

Varias piezas de montaje, tales como el juego de muelles de regulación y el mecanismo de medición, son distintas en las diversas ejecuciones de reguladores. Por tanto es imprescindible que, al sustituirlas, se monten únicamentelas piezas prescritas para la correspondiente ejecución en la lista de recambios.

Para los trabajos de reparación se necesitan algunas herramientas especiales, que se especifican en la lista siguiente (punto 2).
Además, se requieren algunas herramientas auxiliares, que pueden ser confeccionadas fácilmente por el propio taller (piezas torneadas), según los croquis de la página 22 (punto 9).

2. Special Tools

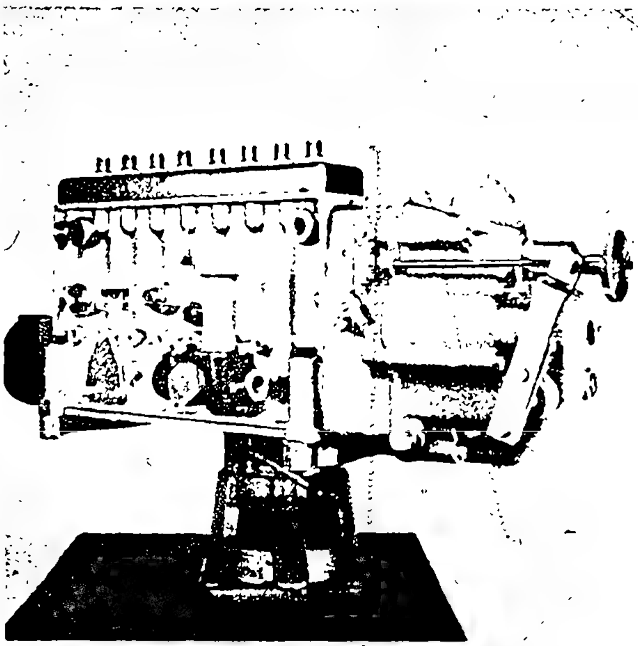
Part Number	Type Designation	Application
0 681 240 048	EF 8498	**Swivel V-vise** for mounting the injection pump with attached governor. (The repair kit includes the swivel V-vise for pump model A.)
1 687 010 005	EFEP 542	**Clamping device** Special accessory of swivel V-vise EF 8498 for pump model P.
—	KDEP 1005	**Clamping device** Special accessory of swivel V-vise EF 8498 for PESV..P.. pumps.
1 683 002 001	EF 8498/37	**Extra-long shaft** — Special accessory of swivel V-vise EF 8498 for clamping 8- and 12-cylinder pumps.
0 681 340 006	EFEP 323	**Gear puller** for removal of the drive gear from the camshaft.
—	KDEP 1028	**Mandrel** for seating the ball bearing in the governor housing and for protection of the oil tube in the shaft of the flyweight assembly.
—	KDEP 1029	**Mandrel** for seating the ball bearing in the driver of the flyweight assembly and insertion of the flyweight unit in the ball bearing of the driver.
0 681 300 001	EFAL 1	**Puller** for extracting the bearing bushing in the sliding sleeve of the control linkage.
1 683 080 000	EFEP 119	**Coupling wrench** for holding the pump drive coupling during removal and mounting of the gear on the camshaft. 10 mm slot width for pump model A.
1 687 951 011	EFEP 356	**Coupling wrench** as EFEP 119 except slot width 12 mm for pump model P.

D3

OS GTC #27

W3P -24416

3. Removal of Individual Assemblies and Removal of Governor from the Injection Pump



1

Mount injection pump with built-in governor in the swivel V-vise 0 681 240 048 – EF 8498.

(See Item 2 "Special Tools", p. 4 for the appropriate clamping device.)

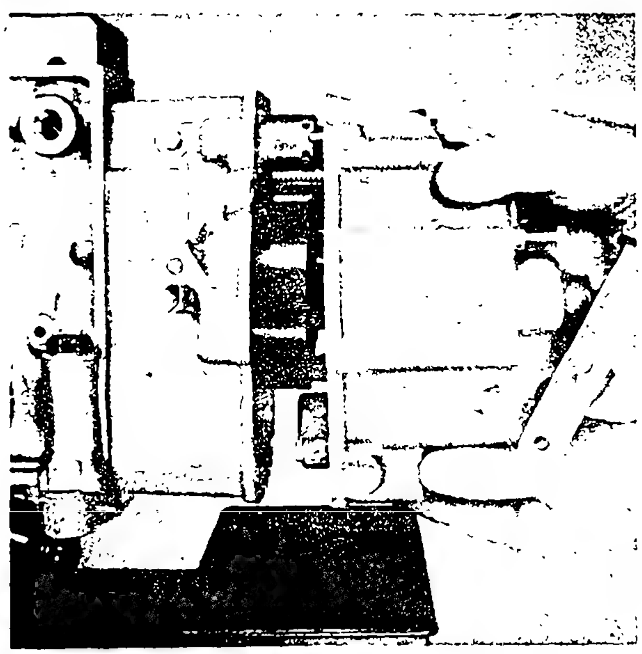
2

Remove adjustment device at the speed control lever of the governor.

Remarks
In governors on PESV pumps, the threaded pin of the adjustment device in certain cases can be removed only after removing the governor housing.

Unscrew cap nut in the governor housing and unscrew the two nuts (adjusting nut and lock nut) from the spring-loaded link fork (extension of the control rod). Pull off the spacer sleeve.

Remove small cover on the governor cover and unhook spring of P-regulation control (per cent) from the fulcrum lever.

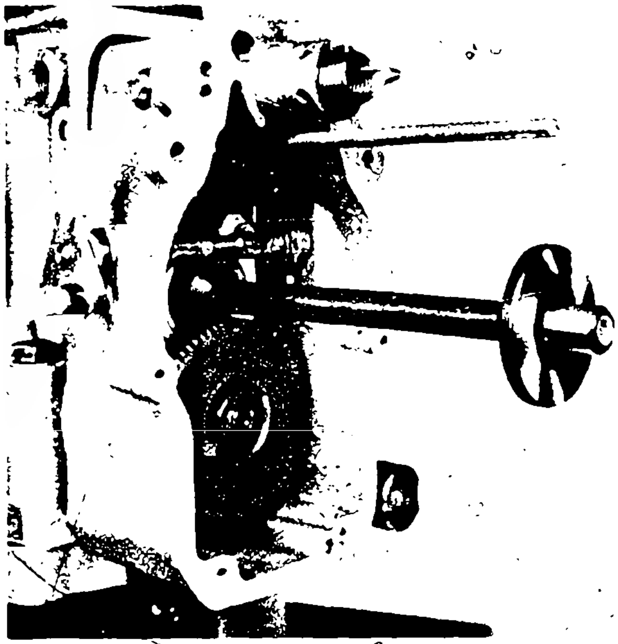


3

Remove fastening screws of the governor cover and lift off governor cover.

Do not cant governor cover because flyweight assembly shaft is supported in it.
Collect the escaping oil.

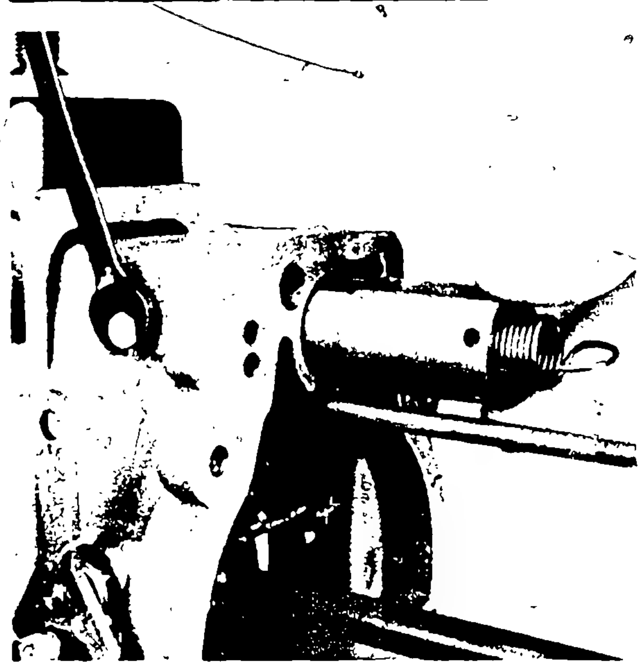
D4



4

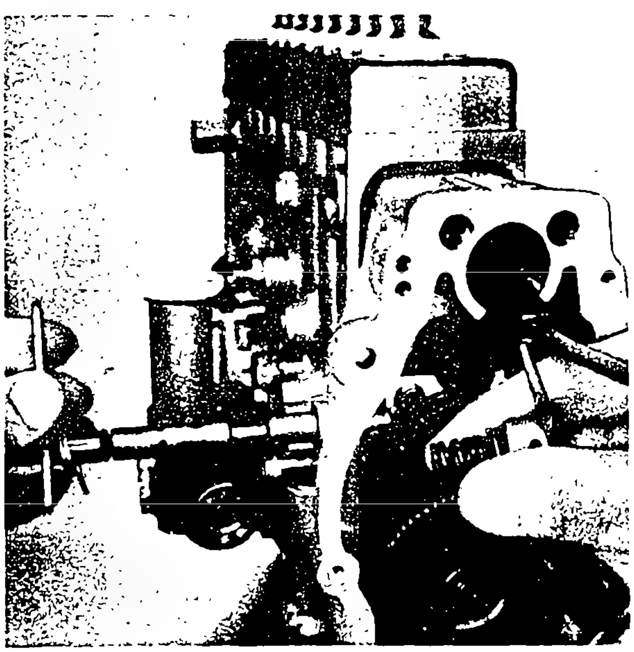
Pull out flyweight assembly shaft with flyweight unit from the ball bearing in the governor housing.

Take care that:
The oil tube which projects freely into the flyweight assembly is not bent. The flyweight assembly shaft must therefore not be canted during removal. Immediately replace the flyweight assembly shaft with mandrel KDEP 1028 by inserting it with the narrow flange forwards in the ball bearing in the governor housing. Should the tube be bent accidentally, it must be replaced (see Item 4).



5

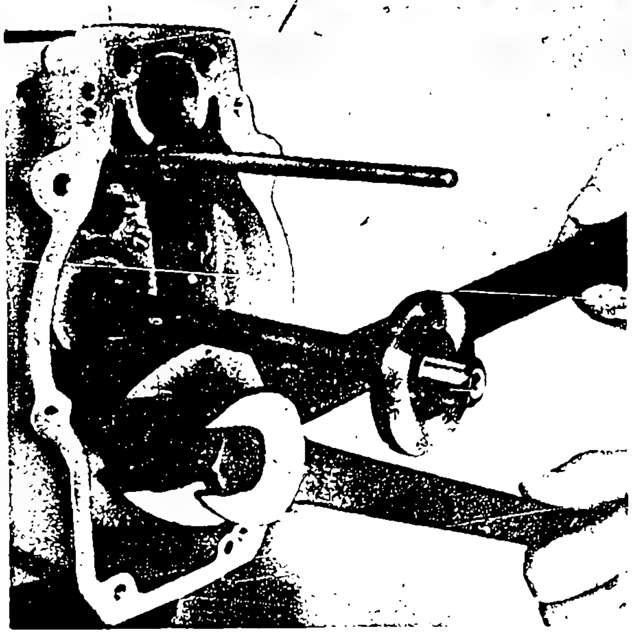
Unscrew the two fastening screws of the P-regulation control and remove the P-regulation control.



6

Remove stop lever with shaft.

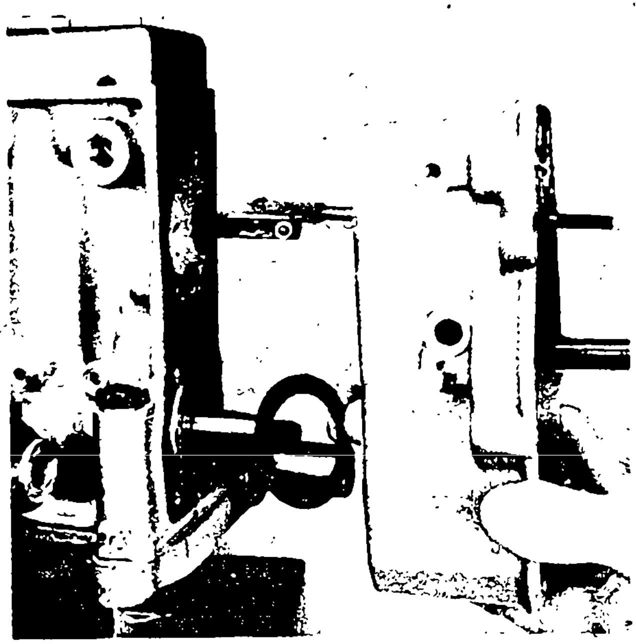
Remove the two grooved pins (locating pins of the inner shut off lever and at the play compensating spring). Withdraw shaft with outer stop lever and torsion spring from the bearing in the governor housing, and in the latter simultaneously remove the inner stop lever, the play compensating spring and the check plate from the shaft.



7

Pull drive gear from the camshaft taper with gear puller 0 681 340 006 – EFEP 323.

Hold drive coupling (coupling wrench, see Item 2, "Special Tools") on the drive side to loosen fastening nut.



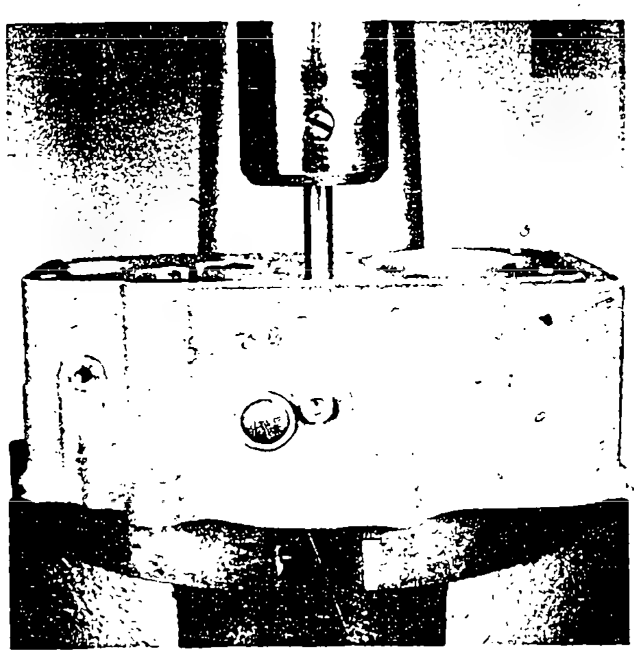
8

Unscrew fastening screws of the governor housing.

In the case of A-pumps, loosen from the guide in the pump housing by lightly tapping with a rubber mallet (do not cant).

In P-pumps, remove governor housing. Do not lose the shim.

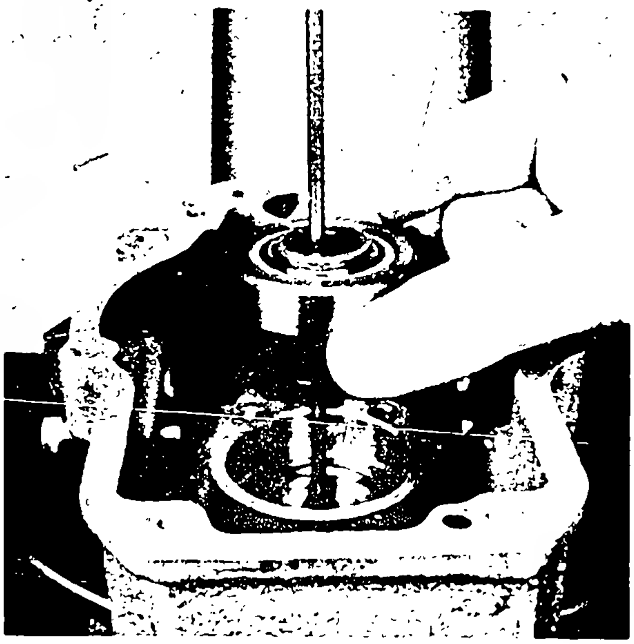
4. Governor Housing Assembly



9

Push out the ball bearing from the governor housing with a mandrel (shop-made auxiliary tool, see p. 22, Sketch 1) through the bore in the back of the governor housing.

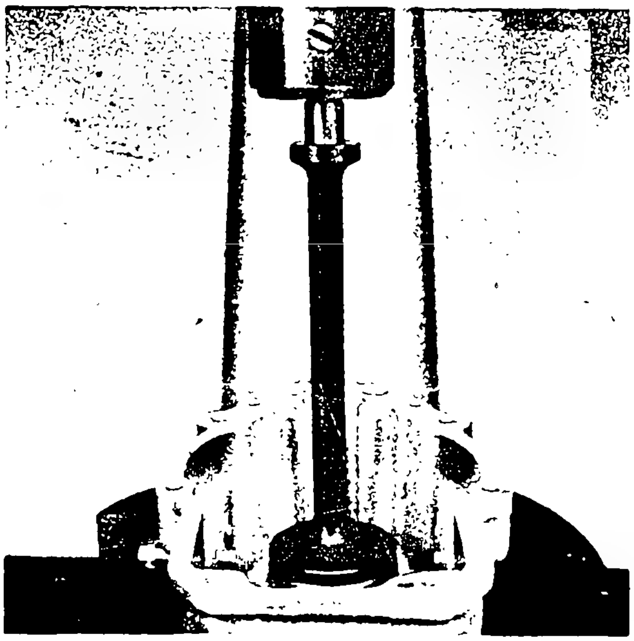
Since the mandrel rests on the oil collecting dish of the oil tube, the latter is damaged and must always be replaced.



10

Fitting the ball bearing.

Place oil collecting dish with oil tube on the seat. Locate ball bearing so that the bushing pressed into the ball bearing inner race points upward.



11

Push in the ball bearing with assembly tool KDEP 1028.

Then turn over assembly tool so that the narrow flange faces the ball bearing. Leave tool in the governor housing to protect the ~~oil tube.~~

5. Flyweight Assembly (Governing Unit)

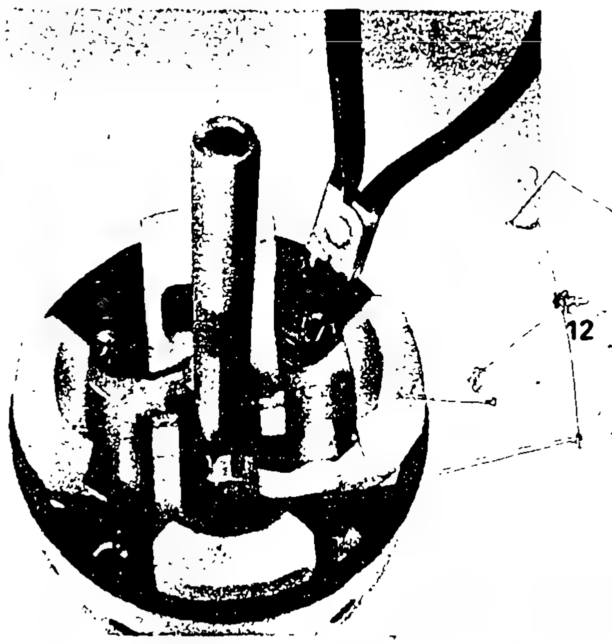
Disassembly, Repair and Reassembly

The flyweight assembly consists of the following main parts: Drive shaft with driver, flyweight unit (flyweight cage with brazed stop ring and the flyweights) and the ball bearing as the connecting link between driver and the flyweight unit. In addition, a torsion spring with one or two turns depending on the governor design is placed between driver and flyweight unit.

The bores of the flyweight unit contain spring-loaded friction pads resting on the driver. The number of friction pads installed differs depending on the governor design. The remaining bores are closed by dummy plugs. The springs for the friction pads and the dummy plugs secure the bearing bolts of the flyweights from axial displacement.

The number of the flyweights – 2 or 4 – also differs depending on the governor design.

Because of the special characteristics of the individual governor designs described above, care must be taken that only those spare parts listed in the appropriate service parts list will be used for replacement.



Remove internal retainers for the friction pads in the flyweight unit. Remove washers and compression springs.

Any existing dummy plugs cannot be pushed out towards the top.

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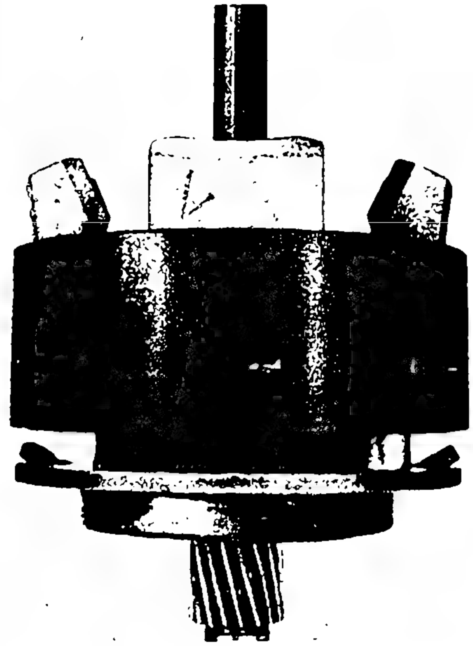
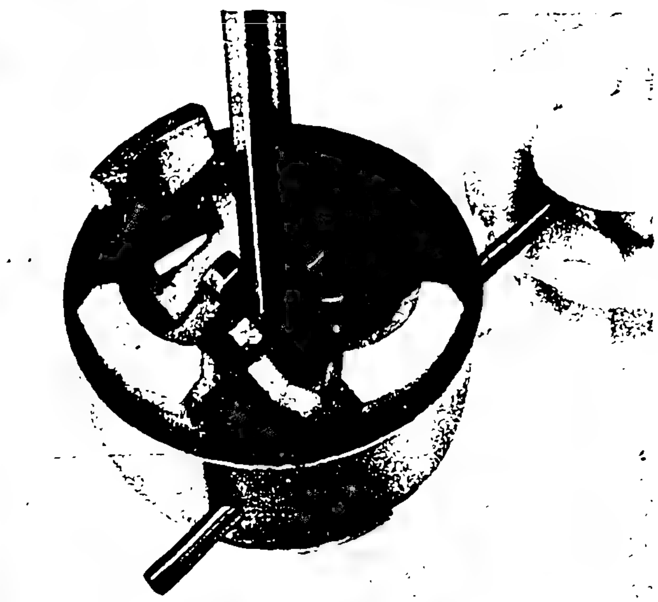


13

Flyweight unit with dummy plugs.

Hold flyweight unit with one hand and push back the driver on the drive shaft by lightly tapping with a rubber mallet until driver and flyweight unit are about 7 mm (1/4 in) apart.

When the dummy plugs are resting on the driver, the bores of the bearing bolts for the flyweights are freed.



14

Push out bearing bolts for the flyweights from the flyweight unit with a mandrel and remove flyweights (bearing bolts have a sliding fit).

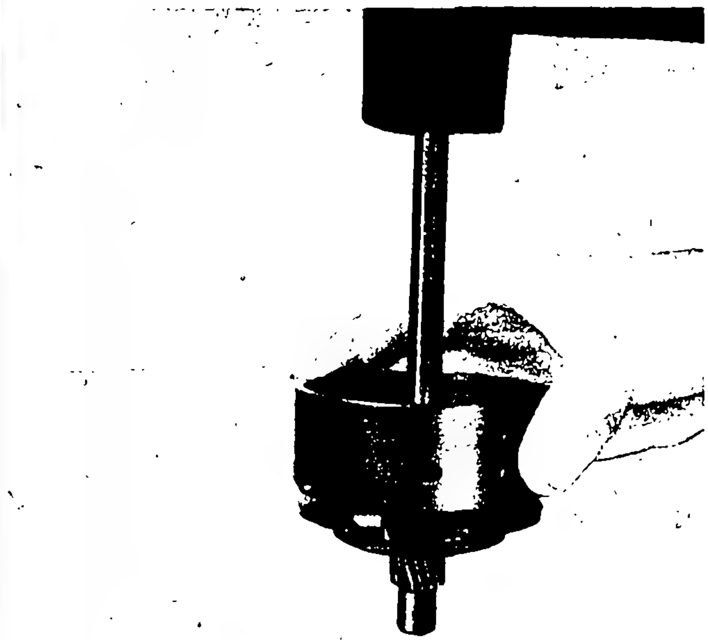
Mark flyweights before disassembly if desired, so that they can be mounted again in the same sequence.

15

Remove internal retainer on shaft and washer.

D9 . X ~~G20~~ G22

WSP 2416

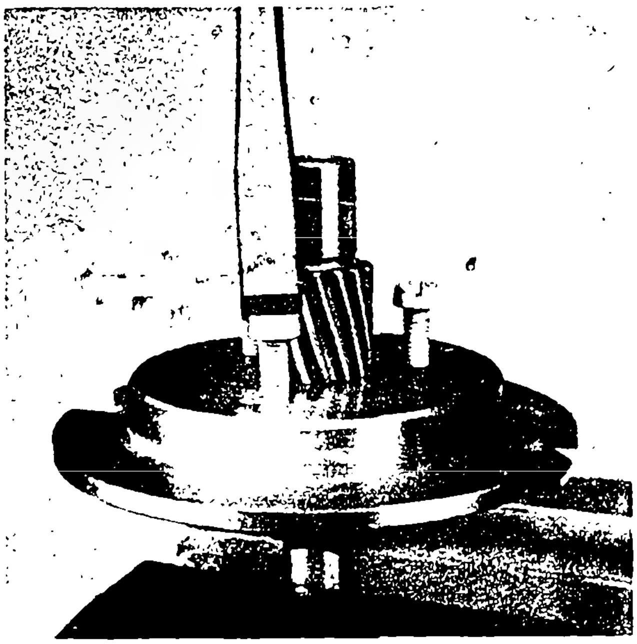


16

Hold flyweight unit with one hand and drive out driver from the flyweight unit by lightly tapping with a rubber mallet on the drive shaft.

The inner bent end of the torsion spring must be pulled from the driver bore.

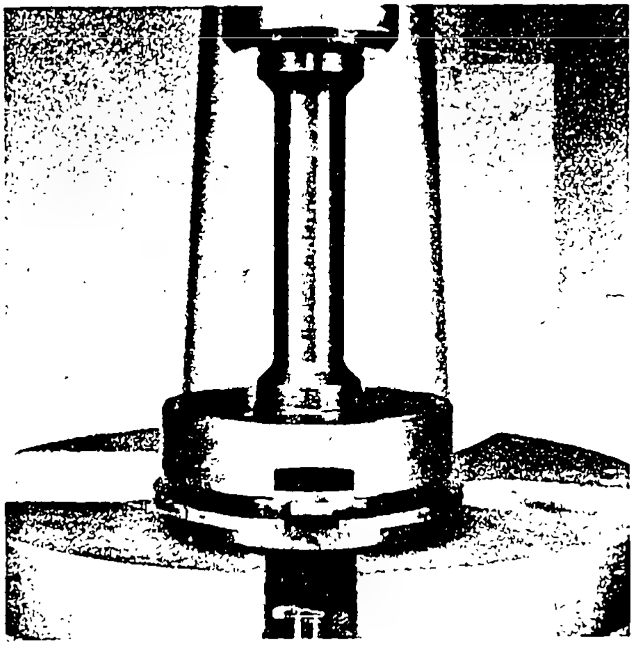
Remove friction pads, dummy plugs and torsion spring from the flyweight unit.



17

Replace ball bearing in the driver.

Three threaded bores M 5 are provided in the driver for removal of the ball bearing. Insert screws (approx. 20 mm, 3/4 in long) into the threaded bores and force out ball bearing from its seat in the driver by uniformly tightening the screws.



18

Press in new ball bearing with mandrel KDEP 1029.

G24 G23

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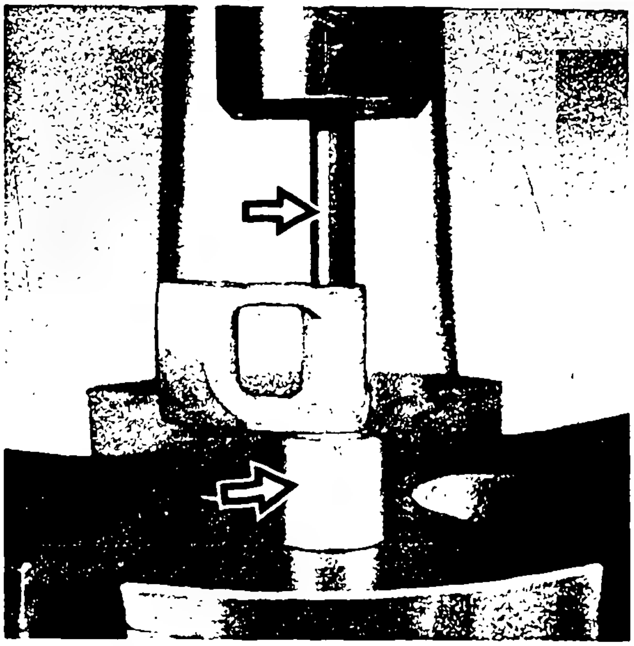
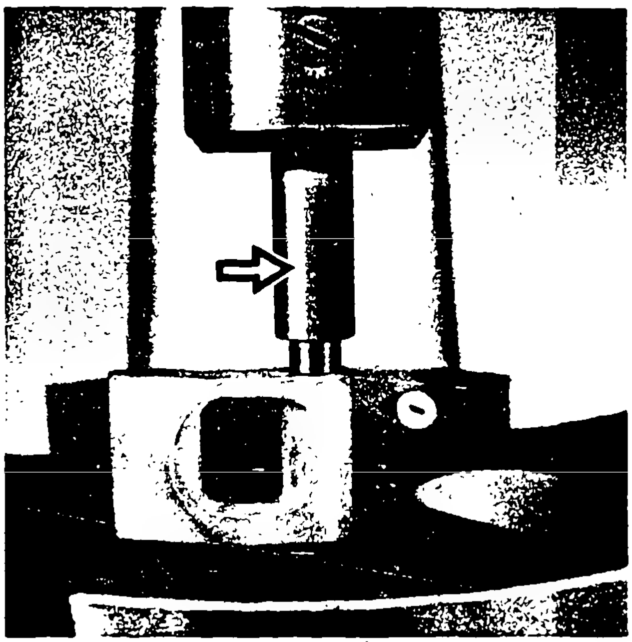


19

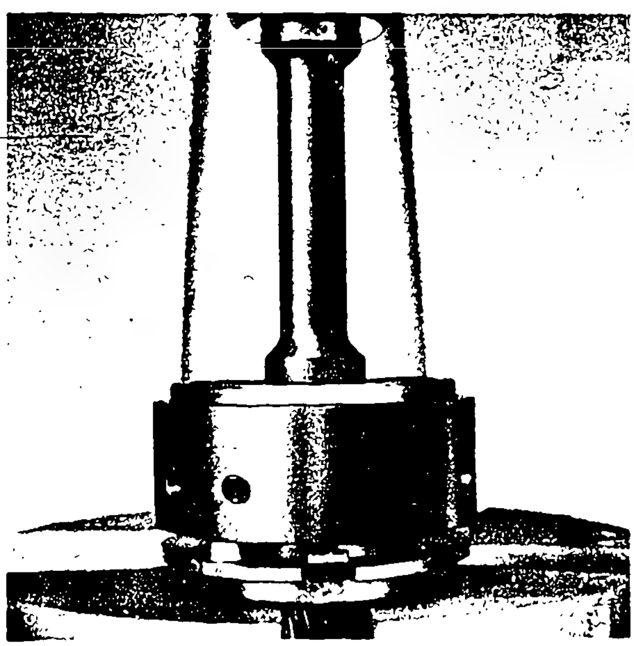
Replacement of the needle bearings in the flyweights.

Simultaneously force out both needle bearings in a hand press. This requires a special mandrel and an appropriate fixture (see arrows, shop-made auxiliary tools, p. 22, Sketches 2 and 3).



20

Locate new needle bearings and fit them flush using a mandrel (see arrow, shop-made auxiliary tool, p. 22, Sketch 4).



21

Insert new torsion spring in the flyweight unit.

Insert dummy plugs in appropriate bores. (Offset by 180° in the case of two plugs.)

Press flyweight unit into the driver with mandrel KDEP 1029. Take care during pressing that the stop lugs of the driver are centered on the recesses in the flyweight unit and that the inner end of the torsion spring mates with the driver bore.

D11

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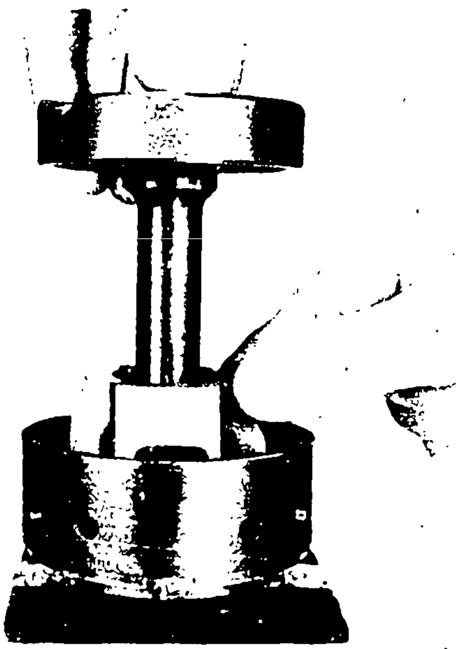
22

Replace washer and internal retainer on the shaft.

The torsion spring should be oriented in such a way that it will not rub on the ball bearing or on the washer and that the stop lugs of the driver are centered on the recesses in the flyweight unit.

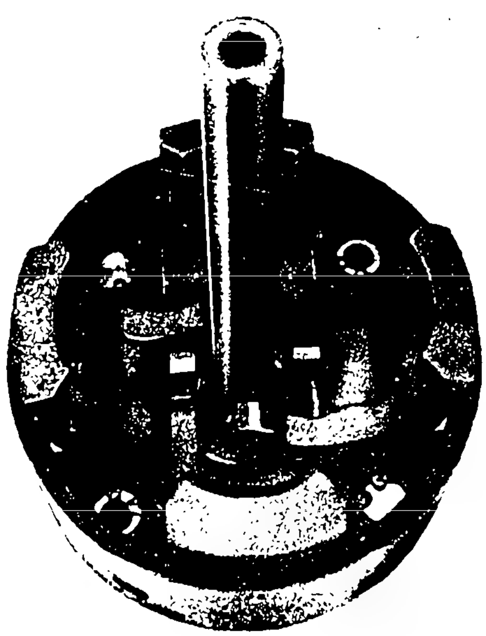


23

Replace flyweights — preferably in the same sequence as before disassembly — and insert bearing bolts.

Clamp flyweight assembly in a vise.

Check play of the flyweights with mandrel KDEP 1029 — the narrow disk rests on the flyweight levers.
None of the flyweights may have a play of more than 1 mm. If necessary, this should be adjusted by interchanging the flyweights or by replacing with new flyweights.



24

Insert friction pads, springs and washers in the appropriate bores and secure with internal retainers. Also secure the dummy plugs with retainers.

D12 DXIX ~~Gt~~ ~~HE~~ ~~44~~

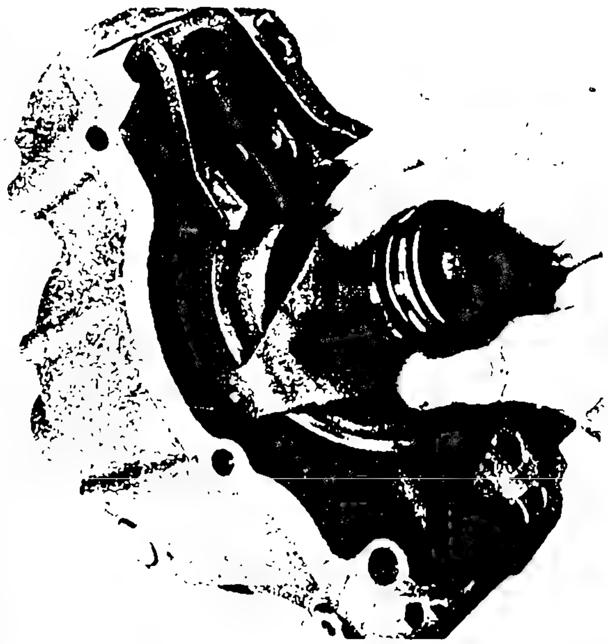
6. Governor Cover Assembly

The governor cover assembly consists of the following main parts:

Governor spring set with spring-seat and stop cup, control lever with internally inserted forked lever, the control linkage consisting of fulcrum lever, stabilizer lever, sliding sleeve and connecting yoke, thrust bearing and the stabilizer with piston and spring.

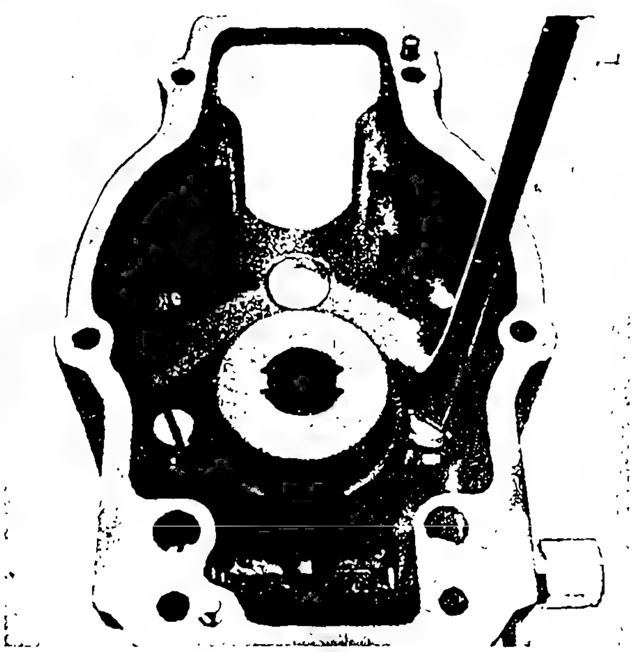
Since, as a basic rule, all seals and gaskets should be replaced when a governor is repaired, it is necessary to remove all of the above parts from the governor cover so that the O-rings on the control lever shaft can be replaced.

In the control linkage, care should be taken that the bearings of fulcrum lever and stabilizer lever in the connecting yoke of the sliding sleeve as well as in the ball and socket in the governor cover and in the small cover do not have too much play. Replace as necessary. The bearing bushing in the sliding sleeve should also be replaced if necessary.
The bearing bushing in the governor cover for the flyweight assembly shaft cannot be replaced with ordinary shop tools.



25

Remove stabilizer and then the complete control linkage with sliding sleeve and thrust bearing from the governor cover (Fig. 25).



26

Remove lock nuts of the full-load adjusting screws on the outside of the governor cover. Unscrew full-load adjusting screws. Remove stop cup, spring set, inner spring seat and the forked lever inserted into the control lever shaft from the governor cover.
Pull out control lever laterally from the governor cover. Remove O-rings from the shaft (Fig. 26).

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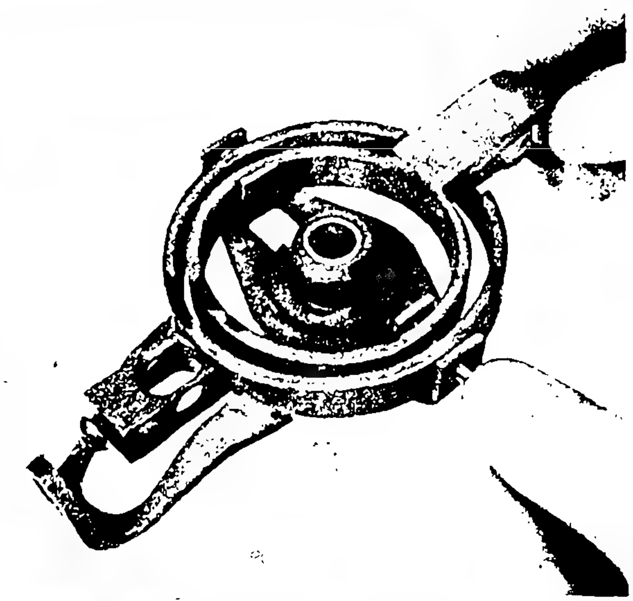
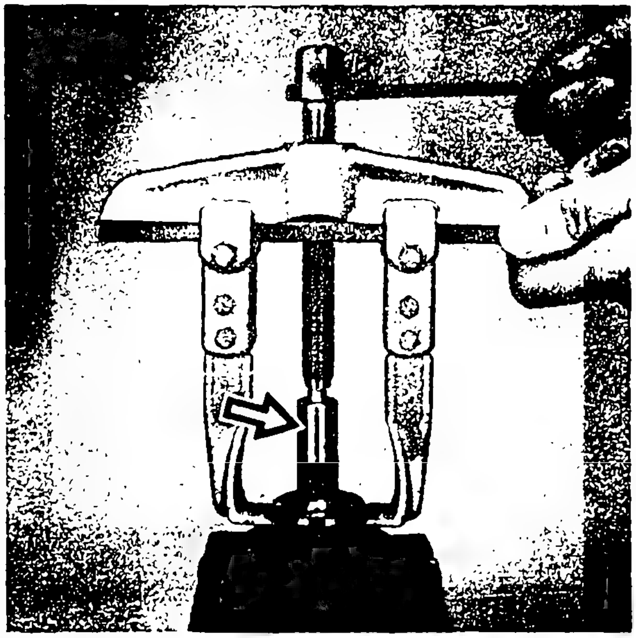


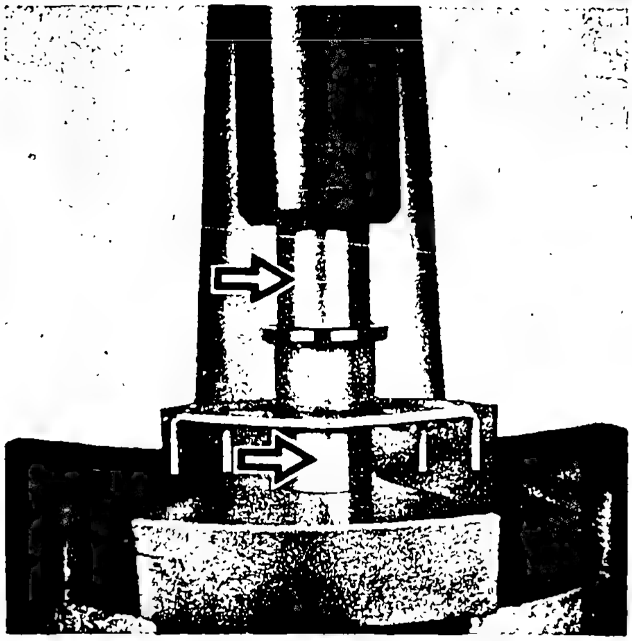
27

If necessary, take the control linkage apart.
For this purpose, remove cotter pins, bearing bolts and washers.



28

Pull the thrust bearing locking collar from the sliding sleeve with puller 0 681 369 011 – EFEP 366. A spacer (see arrow, shop-made auxiliary tool, p. 22, Sketch 5) is required for the set-up point of the tightening spindle of the puller.



29

Force in a new locking collar on the press.

This requires one sleeve each for installation of the locking collar and as a support for the sliding sleeve. (See arrows: shop-made auxiliary tools, p. 22, Sketches 6 and 7).

D14

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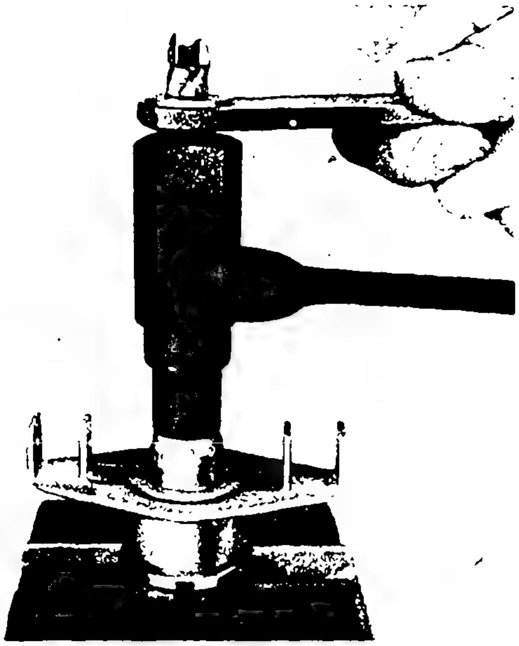
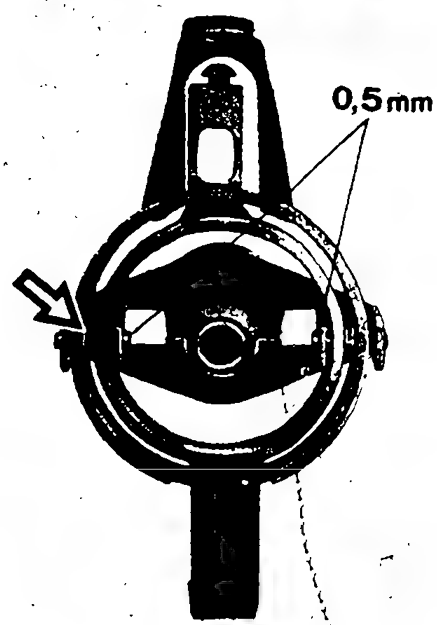


30

Replace bearing bushing in the sliding sleeve.

Extractor 0 681 300 001 – EFAL 1 with the extractor head 1 687 965 031 – EFAL 1/3 (12.5 mm/1/2 in dia.) is suited for this purpose.



31

Assemble control linkage.

Take care that the two bearing bolts on the inside of the sliding sleeve do not project more than 0.5 mm. Adjust by fitting shims of suitable thickness on both sides of the cotter pins. Do not select shims too thick; fulcrum lever and stabilizer lever must move without binding.

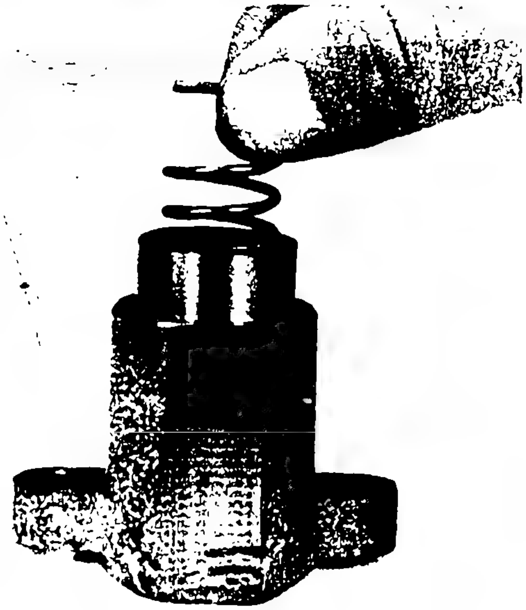
32

Replace stabilizer spring.

For replacement of the stabilizer spring, remove hexagonal nut on the piston base and lift out spring with mounting bolt from the piston.

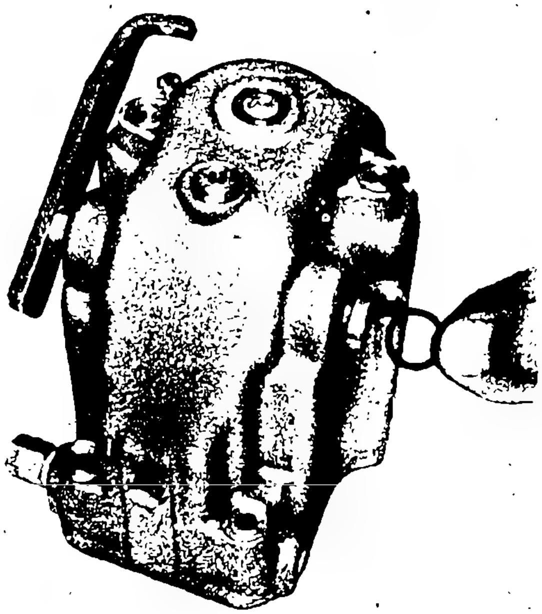
When installing the new spring, take care that the bent spring ends are exactly parallel to each other and are at right angles to the longitudinal axis of the spring.

W3P2HE



The piston of the stabilizer should be free from wear marks or scoring and should move easily over the entire range. Check: The washed piston should slide by its own weight to the stop in the washed cylinder.

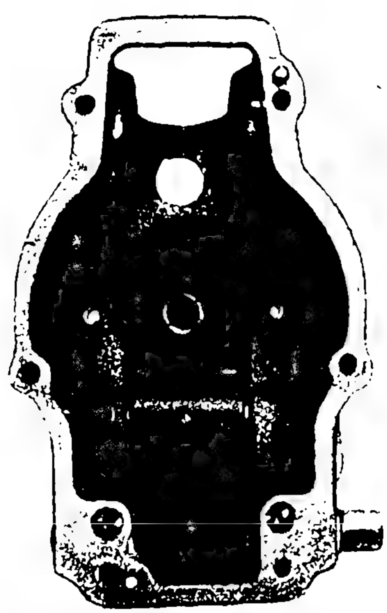
33



Install the governor cover.

Install control lever shaft with control lever. First slip the O-ring onto the shaft on the control lever slide. Push the shaft through until the groove for the O-ring just appears on the side away from the control lever. Insert O-ring.

34



Press control lever shaft back until the forked lever on the inside of the governor cover can be inserted in the shaft. The forked lever secures the shaft from lateral displacement.
Insert spring seat.

35

D16

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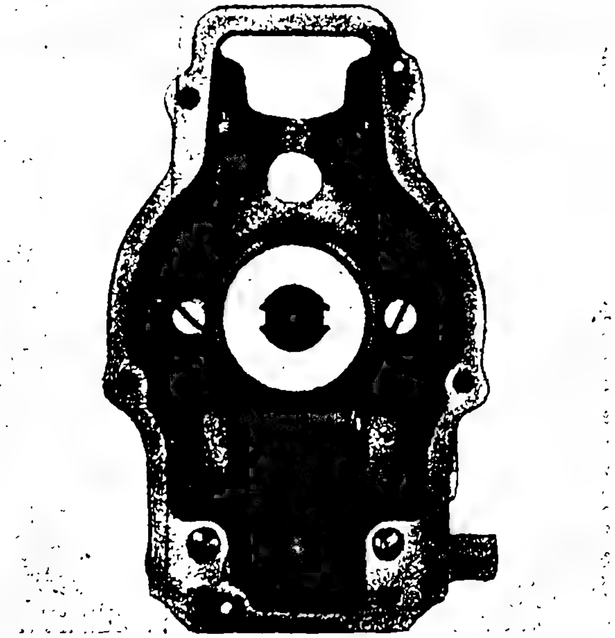
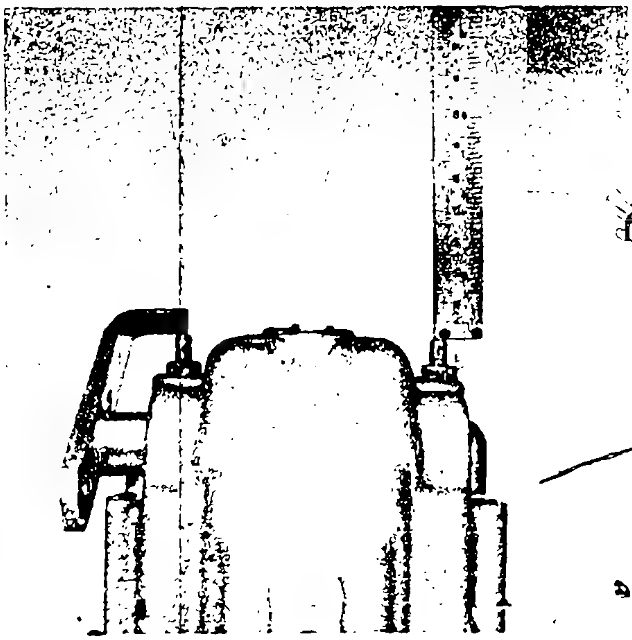


36

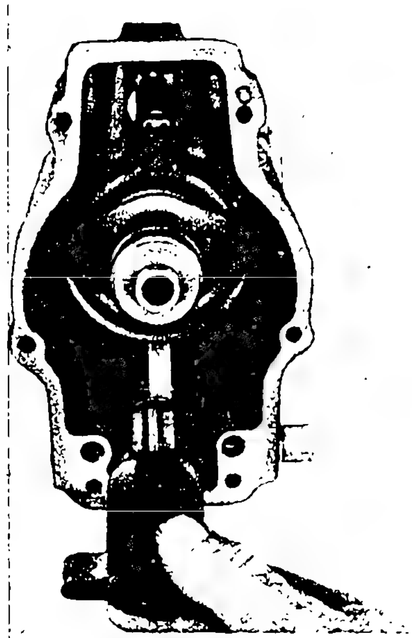
Install governor spring set and stop cup. The two yokes of the stop cup must be aligned with the threaded bores for the full-load adjusting screws in the governor cover.

Coat the thread of the full-load adjusting screws and their lock nuts with Hylomar (Bosch Part No. 5 927 350 002) and screw in both full-load adjusting screws.



37

Preadjust full-load adjusting screws to a projecting height of 12 mm (1/2 in) and lock lightly.



38

Place retaining bolt for the spring-loaded link fork in the fulcrum lever.

Install complete control linkage so that the sliding sleeve is guided in the stop cup and the fulcrum lever in the ball end at the bottom of the governor cover.

Hook stabilizer spring with piston into the stabilizer lever. Place piston in stabilizer cylinder and install the cylinder so that the milled surface points upwards, i.e. towards the center of the governor cover.

Place thrust bearing on the sliding sleeve.

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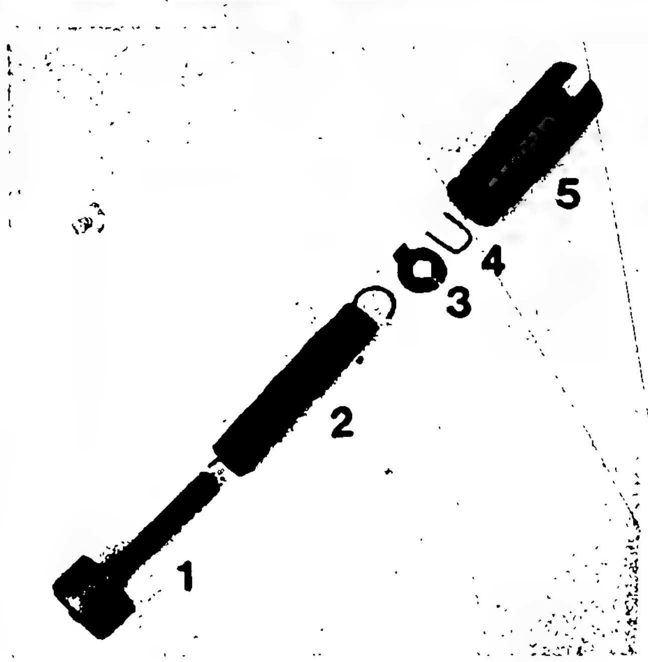


39

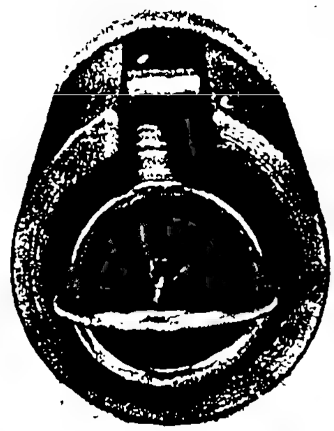
7. P-Regulation Control Assembly

The extension spring in the P-regulation control assembly is identical for all EP/RZU governor designs in Models A and P.

Disassembly of the P-regulation control is necessary only when the spring has broken or has been distorted by careless treatment or otherwise damaged.

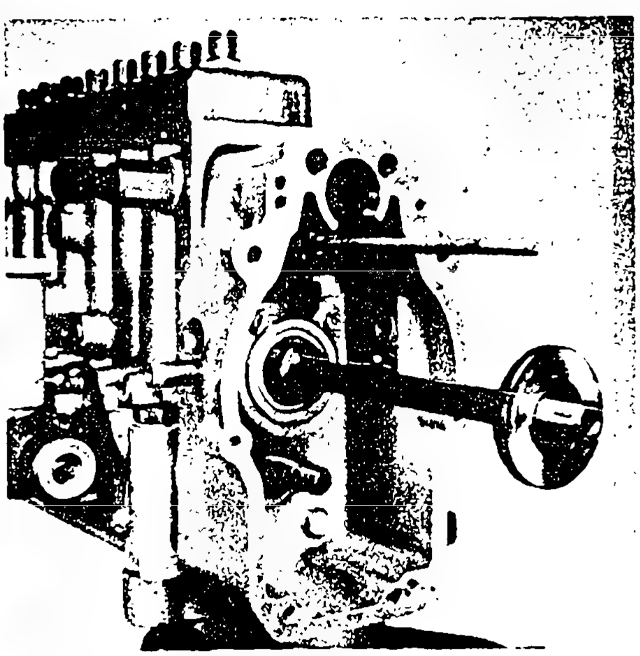
The P-regulation control consists of the following parts: cap with threaded pin 1, spring 2, adjustment washer 3, locking wire 4 and adjustment bushing 5.

For disassembly, pull adjustment bushing from the cap. Remove locking wire from threaded pin. Unscrew adjustment washer from the threaded pin and at the same time pull out from the spring. Pull out spring from the cap.



40

Assembly: Push the spring over the threaded pin so that pin end of the spring is guided in the bore in the face of the cap and the last turn of the spring is flush in the cap. Screw adjustment washer into the spring and onto the threaded pin to about one-half the spring length. Attach the locking wire to the end of the threaded pin. Insert adjustment bushing over the spring into the cap so that the adjustment washer is guided in the longitudinal slot.



41

8. Installation and Assembly of the Governor

Install governor housing.
Do not forget to place a new gasket between pump housing and governor housing.

In P-pumps, also do not forget the adjustment washer for the camshaft projection. (See repair instructions for P-pums VDT-WJP 115/1 B).

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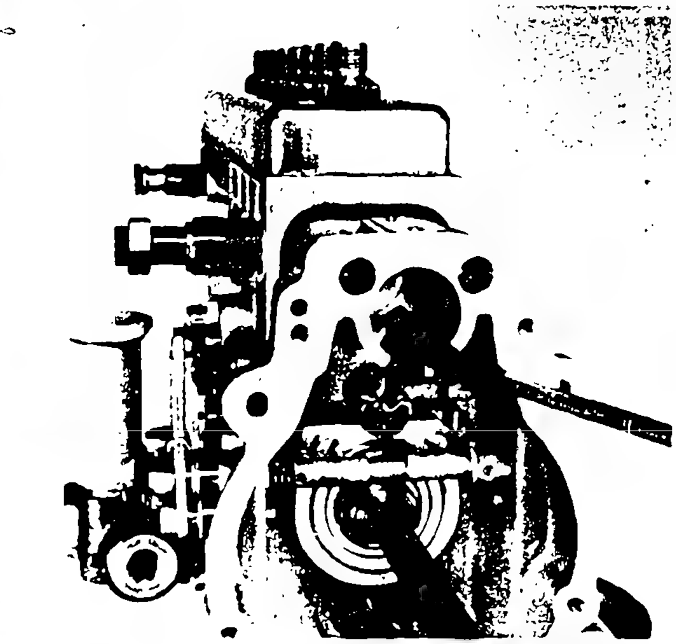
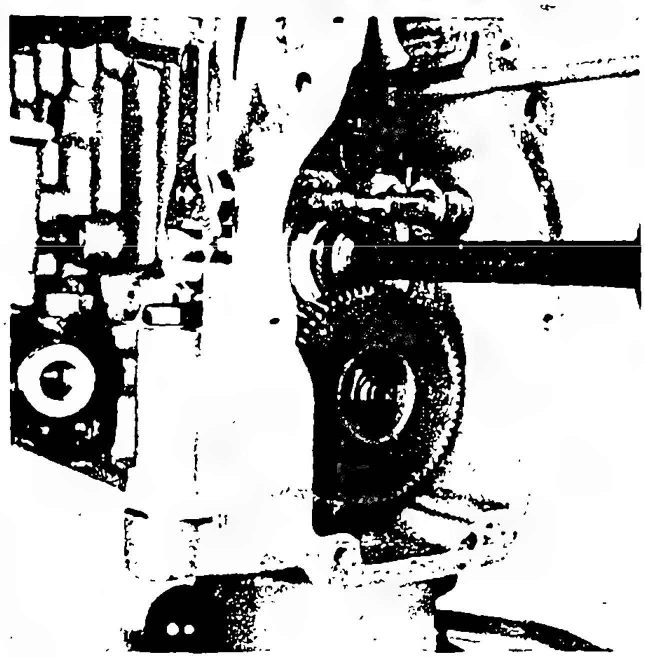
Install stop lever shaft with stop lever.

Insert shaft with O-ring and torsion spring. At the same time, push play-compensating spring, washer and inner stop lever on the shaft. Insert locking pins for play-compensating spring and inner stop lever.



42

Place key in taper of the camshaft and install driving gear.



43

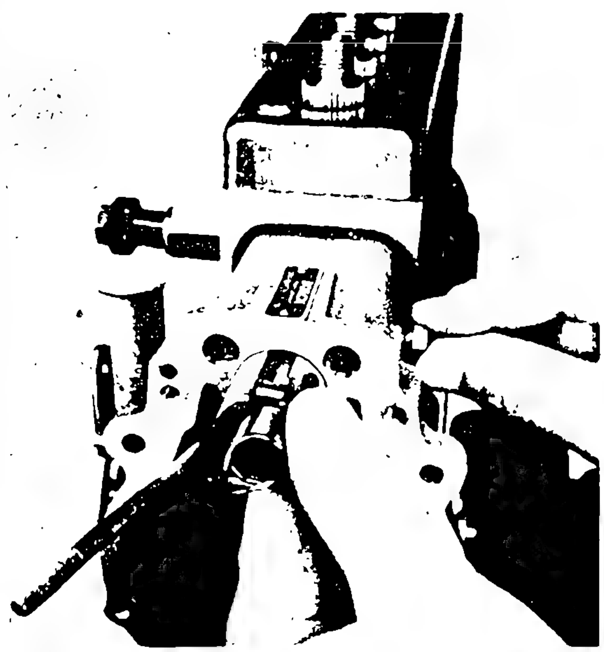
Install P-regulation control.

Before installation, take care that the annular groove of the adjustment bushing is visible in the two guiding bores of the cap.

Installation position of the spring: Hook horizontal, first turn of the spring, must point upwards and rotate clockwise (see arrow in Fig. 45).

In the installed state, the P-regulation control is held in the bores of the cap by the two fastening screws with turned pegs and at the same time the adjustment bushing is secured from shifting.

Do not forget the gaskets on the fastening screws.



44

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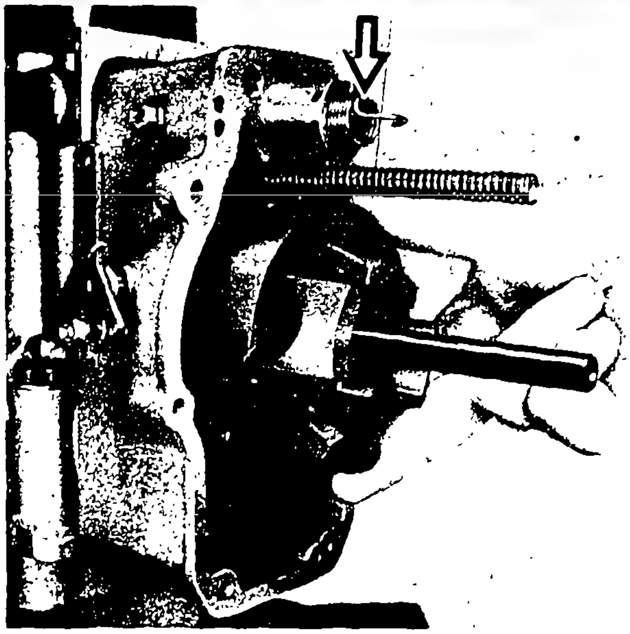
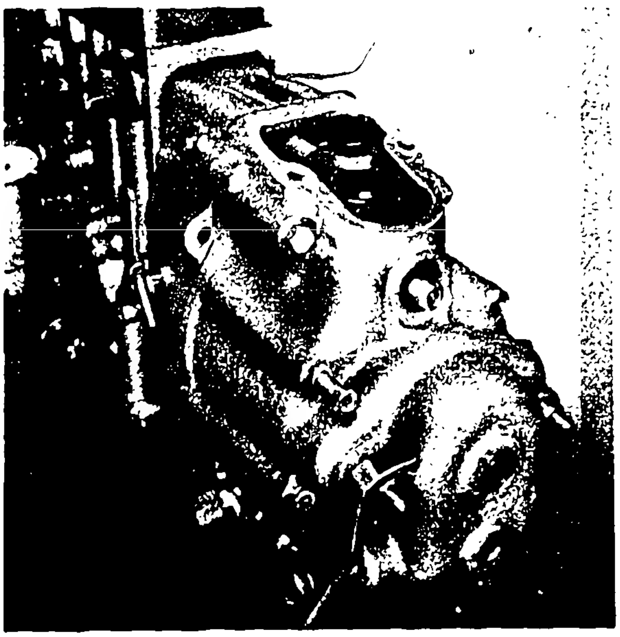


45

Coat flyweight assembly shaft with Molykote paste (Bosch Part No. 5 700 040 210 – Ft 70 v 1) on the bearing points for the sliding sleeve of the control linkage and for the bearing bushing in the governor cover.

Remove mandrel KDEP 1028 and insert the flyweight assembly in its place.

Caution: The oil tube must not be bent!
Install spring for the spring-loaded link fork.



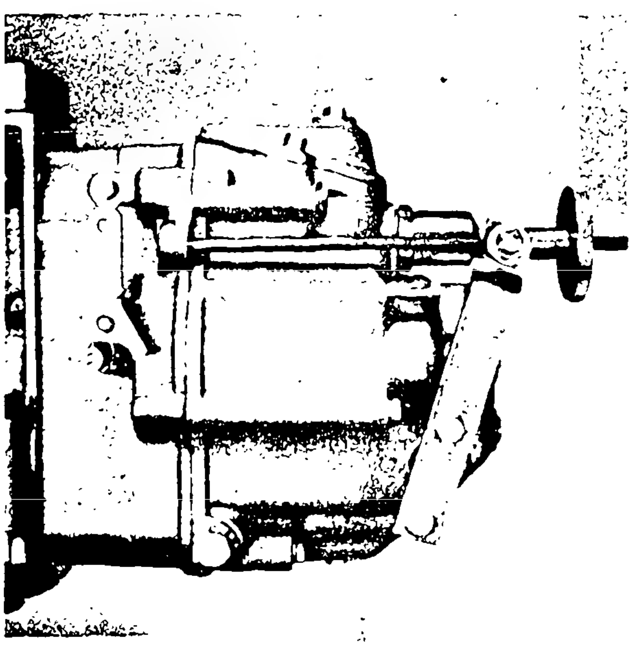
46

Paste new gasket between governor housing and governor cover in position using a small amount of grease on governor cover and install completely assembled cover.

Take care that the stud of the spring-loaded link fork is guided in the retaining bolt in the fulcrum lever.

Hook spring of the P-regulation control into the fulcrum lever.

Place spacer bushing for the spring-loaded link fork on the threaded pin. Screw adjustment nut and lock nut in until the lock nut is flush with the stud head.



47

Paste the new gasket for the small cover on the top of the governor cover into position using a little grease and position the cover. The ball head of the closing cover should mate with the stabilizer lever.

Tighten screws of cover.

Provide a gasket for the cap nut over the adjustment nuts of the spring-loaded link fork and tighten.

Install adjustment device for the control lever (fine adjustment, mechanical or electrical).

Check and adjust governor according to Testing Instructions VDT-WPP 001/4 B, 4th supplement.

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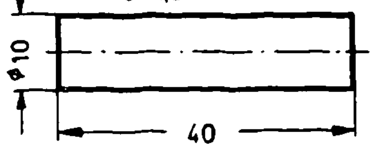
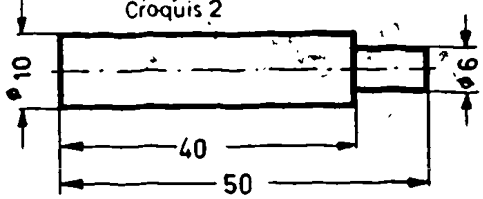
9. Auxiliary Tools (Shop Manufacture)
9. Outillage auxiliaire (à réaliser par vos soins)
9. Herramientas auxiliares (de propia confección)

Material: Steel
Matériau : acier
Material: acero

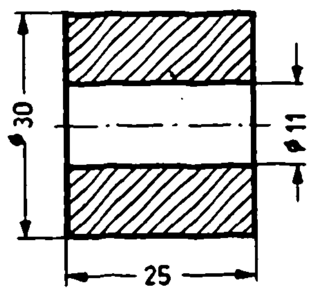
Sketch 1
Croquis 1



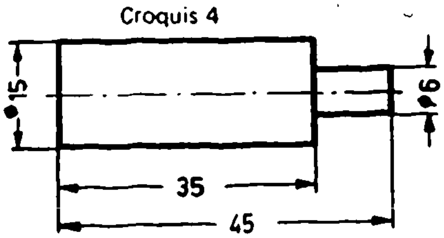
Sketch 2
Croquis 2



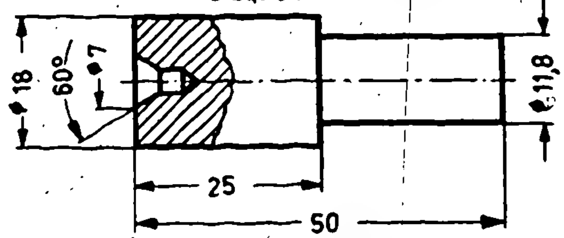
Sketch 3
Croquis 3



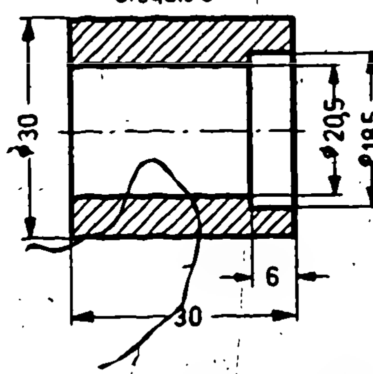
Sketch 4
Croquis 4



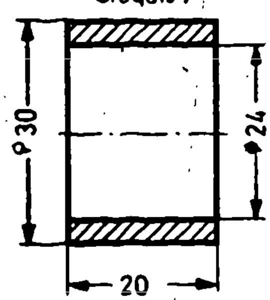
Sketch 5
Croquis 5



Sketch 6
Croquis 6



Sketch 7
Croquis 7



Application:

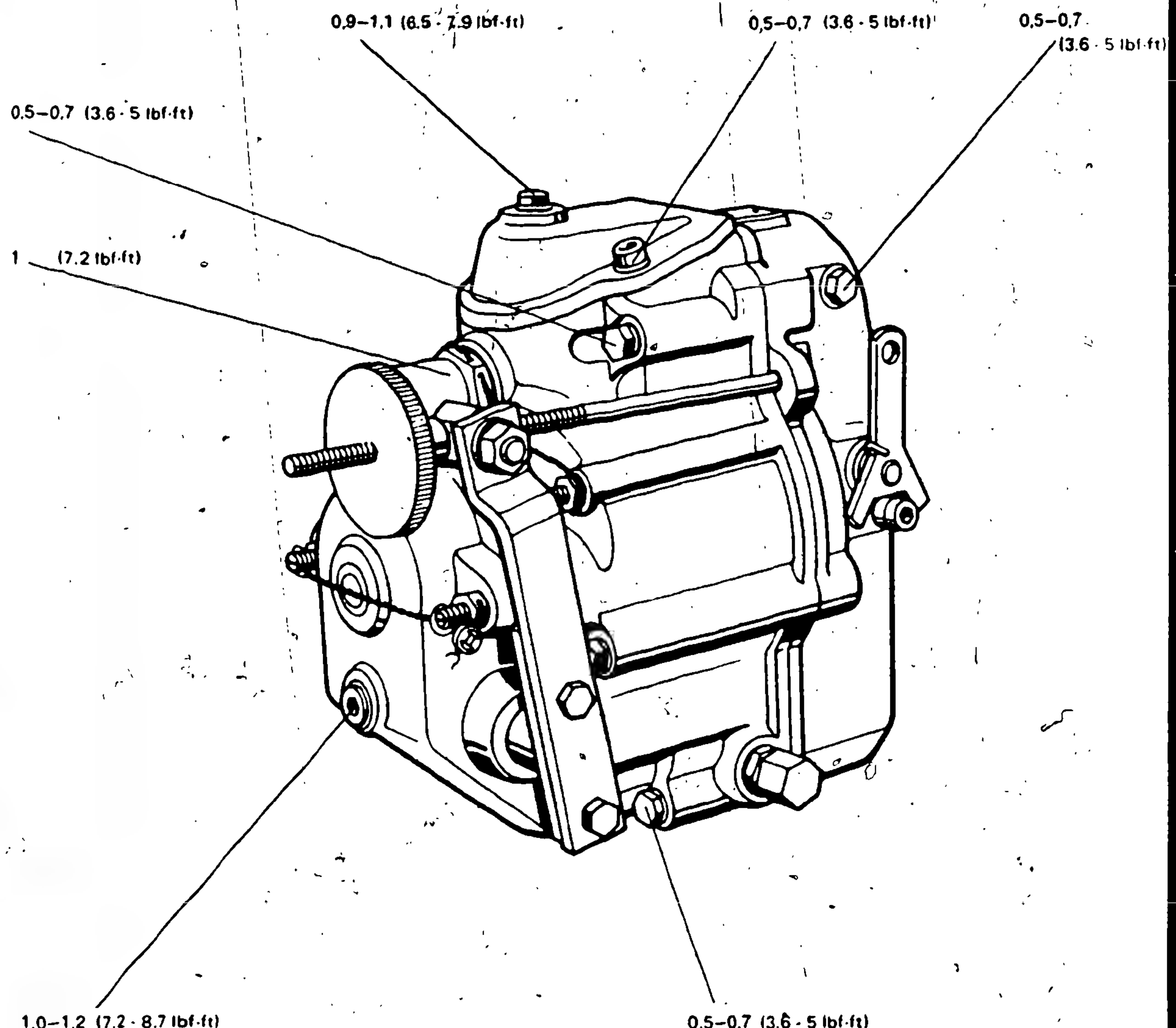
Sketch 1	Mandrel to remove the ball bearing from the governor housing (Fig. 9)
Sketch 2	Mandrel to remove the needle bearings from the flyweights (Fig. 19).
Sketch 3	Sleeve to support the flyweights while removing the needle bearings (Fig. 19)
Sketch 4	Mandrel to seat the needle bearings in the flyweights (Fig. 20)
Sketch 5	Spacer to remove the thrust bearing race from the sliding sleeve (Fig. 28)
Sketch 6	Sleeve to seat the thrust bearing race (Fig. 29).
Sketch 7	Sleeve to support the sliding sleeve while seating the thrust bearing race (Fig. 29).

071 ~~320~~ ~~110~~ ~~118~~ ~~312~~ ~~110~~

WJP 2416

10. Tightening Torques

Fastening nut for gear on the camshaft:	5 - 6 kgf·m (36.1 - 43.4 lbf·ft)
Fastening screws of the governor housing:	0.9 - 1.1 kgf·m (6.5 - 7.9 lbf·ft)
Fastening nut for stabilizer spring:	0.4 kgf·m (2.9 lbf·ft)
Lock nut on the spring-loaded link fork:	0.4 kgf·m (2.9 lbf·ft)



D22

D22

Just lately, more and more cases have occured where the testing and adjustment of injection-pump assemblies have not been carried out in accordance with the valid Bosch guidelines (Test Specifications, Test-Specification Sheets).

It was ascertained in these cases, that during the checking of injection-pump assemblies the <u>setting tolerances</u> were applied as the permissible maximum limit value instead of the prescribed <u>checking tolerances</u> (values in brackets). We are forced to point out, that when this happens a warranty case procedure <u>cannot</u> apply and the customer must pay for the checking of the injection-pump assembly in question.

In further cases, the full-load injected fuel quantity was set at the upper limit of the <u>checking tolerance</u> instead of within the <u>setting tolerance</u>. This is forbidden and can lead to a reduction of the life expectancy of the engine.

We must point out that this fact has led to complaints being received from a number of vehicle manufacturers regarding the full-load quantity setting.

As a matter of principle, the <u>checking tolerance</u> must NOT be used for setting purposes or for checking a setting which has just been carried out.

The existing, valid test specifications MUST be complied with in full.

BOSCH Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung
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0 400 640 067
0 400 648 085, ..086,
0 400 846 308
Complaints concerning the rocker arm in the governor on MAN engines D 2538 MT, D 2156 MTN 5-Saviem and KHD engines BF 12 LO 148 Z

The MAN engine D 2538 MT is fitted with injection-pump assembly

0 400 648 085 comprising: PE 8 A 95 D 320 LS 2421
RQ 250/1250 AB 845 DR - 0 420 203 095

0 400 648 086 comprising: PE 8 A 95 D 320 LS 2421
RQV 250...1250 AB 846 DR - 0 420 215 058

The MAN-Saviem engine D 2156 MTN 5 with injection-pump assembly

0 400 846 308 comprising: PES 6A 95 D 410 RS 2128
RQ 200/1100 AB 860 DL - 0 420 202 248

The KHD engine BF 12 L 0148-Z with injection-pump assembly

0 400 640 067 comprising: PE 12A 95 D 610/4 LS 2449
RQV 300...1250 AB 896 L - 0 420 202 055

As from FD 331 a soldered rocker arm (item 3/3 on microfiche EP..) was introduced with these injection-pump assemblies, the bolt having previously been riveted. Inadequate soldering can result in the bolt working loose and falling out, thus impairing the performance of the governor. The vast majority of these injection-pump assemblies have already been dealt with in one campaign and the rocker arm was changed. To denote this a blue spot was made (fig. 1) next to the solenoid fitted on the side of the governor. The rocker arms were also given a blue spot once they had been checked..
The defect has been eliminated in series production as from FD 622.

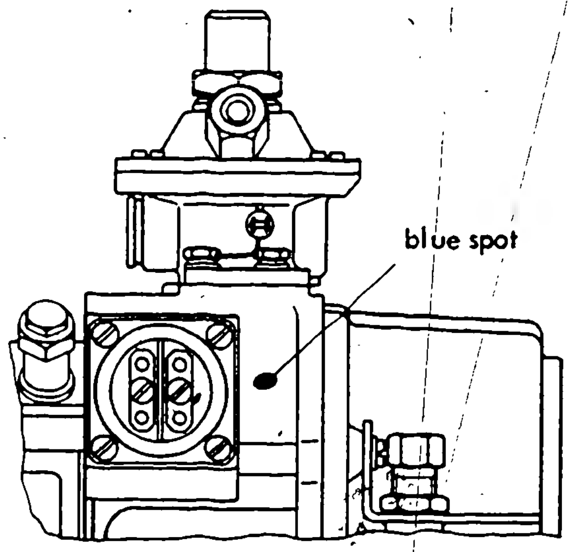

Fig. 1

Should such a case present itself, or should an injection-pump assembly made between FD 331 and FD 622 (without blue spot) be brought in for repair, then a new rocker arm must be fitted.
The new rocker arms have the part numbers 1 421 960 063 and ..064. Old rocker arms 1 421 960 052 and ..054 should be removed from stock, disposed of, and reported for crediting under warranty.

Should it be necessary to change only the rocker arm, then it is not necessary to re-set the pump on the test bench. The procedure is as follows:

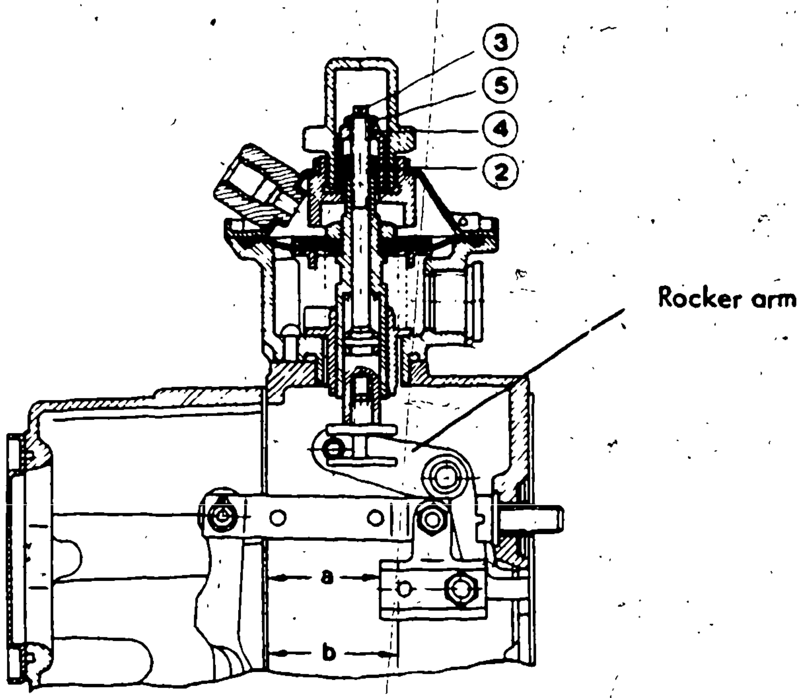

Fig. 2

1. Remove the governor cover and cover up the flyweight assembly, so that parts (circlips) which have been screwed off or removed do not fall into the governor.

2. Release the control rod fastening at the upper M5 nut.

3. Use a depth gauge to press the control rod up against the rocker arm. Take measurement "a" (fig. 2) and write it down.

4. Loosen the union cap on the manifold-pressure compensator. Push shaft 3 through up to the stop. Take measurement "b" (fig. 2) and write it down.

   Important: Repeat the measurements several times with the same pressure on the control rod to make sure that the same measurement is obtained.

5. Remove the solenoid.

6. Remove the locking washers (circlips) from the lever shaft. Pull out the shaft as far as necessary to allow the rocker arm to be removed.
   <u>Caution! The circlip may drop out.</u>

7. Push the new rocker arm onto the shaft. Insert the locking washers with a holding tool (Benzing No. 5 CRV).

8. Refit the solenoid.

9. <u>Taking measurement "a":</u>
   Use the depth gauge to press the control rod up against the rocker arm. The distance measured should not have changed since the original measurement was made.

   If the measurement has altered, proceed as follows:
   - Loosen lock nut 5 and cover 4
   - Loosen lock nut 2. Turn shaft 3 with a screwdriver, lock it, and measure. Repeat the process until the measurement "a" calculated previously has been attained. Then lock securely.

10. <u>Taking measurement "b":</u>
    Screw on cover 4, push it onto shaft 3 and lock it. Take measurement "b" with a depth gauge and compare it with the value obtained beforehand. Turn the cover until measurement "b" has been attained. Then lock it securely.

11. Screw on the union cap, and tighten it firmly.

12. Lead the threaded pin into the control rod fastening and screw it tight.

13. Insert the governor cover and lightly tighten the two central screws.

14. Ensure ease of control rod movement by moving the control lever back and forth whilst at the same time pushing the governor cover. When the control rod is at its easiest to push, tighten up the governor cover.

Seiley

15. To show that a new rocker arm has been fitted be sure to make the blue spot marking next to the solenoid (fig. 1).

Warranty procedure

The rocker arm should be replaced free of charge even outside the warranty period. We will reimburse 10 work units for this. Please claim under warranty category 9 using defect number 94.

D27

Register 40...46, 58
File Identity VDT-I-401/104 En
3.1986

NEW INJECTION-PUMP ASSEMBLIES

for Mercedes-Benz engines

OM 422A and 422 LA

Due to a change to the engine camshaft on Mercedes-Benz engines OM 422 A and OM 422 LA, new injection-pump assemblies have been specified for these engines.

1. OM 422 A

Previous injection-pump assemblies:

PE 8 P 120 A 320 LS 3807-10 +
RQ 300/1150 PA 546-3
Assy No. 0 401 848 733 and
PE 8 P 120 A 320 LS 3807-10 +
RQV 300 - 1150 PA 545
Assy No. 0 401 848 732

have been replaced by:

PE 8 P 120 A 320 LS 3807 - 10 +
RQ 300/1150 PA 546-4
Assy No. 0 401 848 760 and
PE 8 P 120 A 320 LS 3807 - 10 +
RQV 300 - 1150 PA 545 - 2
Assy No. 0 401 848 762

2. OM 422 LA:

Previous injection-pump assemblies:

PE 8 P 120 A 320 LS 3807 - 10 +
RQ 300/1150 PA 546 - 2
Assy No. 0 401 848 753 and
PE 8 P 120 A 320 LS 3807 - 10 +
RQV 300 - 1150 PA 545 - 1

have been replaced by:

PE 8 P 120 A 320 LS 3807 - 10 +
RQ 300/1150 PA 546 - 5
Assy No. 0 401 848 761 and
PE 8 P 120 A 320 LS 3807 - 10 +
RQV 300 - 1150 PA 545 - 3
Assy No. 0 401 848 763.

The fuel-delivery settings of the new injection-pump assemblies have been matched to the installation of the changed engine camshaft.

Caution:
On engines of type OM 422 LA, in the transitional phase from engine end no. 109505 to 118563, although changed engine camshafts have been installed, the old-type injection-pump assemblies have been installed.

In this case, the old-type injection-pump assemblies that have been installed have been factory-set to the fuel-delivery settings of the new injection-pump assemblies.

When checking or resetting one of the previous injection-pump assemblies listed under 2. above, therefore, it must under all circumstances be ensured that the customer find out the end number of the engine. Only then is it possible to decide which test-specification sheet to use.

The new injection-pump assembly is installed as of engine end number 118564.

Note:
The new injection-pump assemblies must not be installed in engines OM 422 A / LA with old engine camshaft.

This does not affect the start-of-delivery settings.

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for Training and Technology
(KH/VSK)

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MODIFICATION TO THE DELIVERY-VALVE HOLDER
OF FUEL-INJECTION ASSEMBLIES
0 401 846.., ..848.., ..876...

VDT-I-401/102 En
8.1983

In the following fuel-injection pumps, which are fitted in Mercedes-Benz coaches and commercial vehicles with naturally-aspirated engine, the delivery-valve holder 2 413 371 118 (with return throttle) has been changed to 2 413 371 090 (without return throttle) as from date of construction FD 344:

Fuel-injection pump	Fuel-injection assembly
PE 6P 110A 320 LS 3805	0 401 846 738
	.. 739
	.. 740
	.. 748
	.. 749
	.. 755
	.. 756
	.. 762
	0 401 876 717
PE 6P 110A 320 LS 3814	0 401 846 741
	0 401 876 723
PE 8P 110A 320 LS 3802	0 401 848 708
	.. 712
	.. 737
	.. 738
	.. 739
PE 8P 110A 320 LS 3802-1	0 401 848 751
	.. 752
PE 8P 110A 320 LS 3813	0 401 848 740

Delivery-valve holder 2 413 371 090 can be recognized by its short form, 57 mm high, compared with delivery-valve holder 2 413 371 118 which is 68.5 mm high.

The service-part lists for the relevant fuel-injection pumps will be amended accordingly.

For test specifications see the relevant microcards WP ..

Kenntnis genommen:	Bearbeiter	Inhaber	Meister	Mechaniker
Noted by:	Project Specialist	Owner	Supervisor	Mechanic

Fuel injection pumps, size M, A, B, P, Z
Camshaft extension

VDT- BMP 001/67 B
Edition 9.71
Translation of German edition of 2.8.1971

EP 41

To our foreign representatives

For technical reasons the camshaft extensions on the various pump sizes have been changed as follows:

Pump type	Camshaft extension +)
PES..M..	9.8 ± 0.5 mm (25/64" ± 1/32") up to now 9.5 mm (3/8")
PE (S)..A..	9.8 ± 0.5 mm (25/64" ± 1/32") up to now 9.5 mm (3/8")
PE (S)..A.. with long camshaft	13.8 ± 0.5 mm (35/64" ± 1/32")
PE (S)..B..	9.8 ± 0.5 mm (25/64" ± 1/32") up to now 9.5 mm (3/8")
PE (S)..P..	13.8 ± 0.5 mm (35/64" ± 1/32") up to now 13.5 mm (17/32")
PE..Z..	12.8 ± 0.5 mm (32/64" ± 1/32") ~~up to now 12.5 mm (1/2")~~

Please alter the measurements accordingly in the Repair Instructions WJP 101/1 B, WJP 101/2 B and WJP 115/1 B.

This modification will be taken into account in case of reprint of these instructions.

+) The values are approximate.

40...46, 58
VDT-I-400/109 En
2.84
Supersedes Ed. 5.1981

TESTING FOR LEAKS ON IN-LINE FUEL-INJECTION PUMPS

Due to more stringent requirements, and as a result of the latest knowledge gained in this field, the following points are to be noted when carrying out the seal testing on the M, MW, A and P-size in-line fuel-injection pumps.

1. Test conditions

Only clean, clear calibration oil as per ISO-4113 is to be used for testing. The submersion tank is only to hold sufficient oil for the injection pump to be covered completely. The calibration-oil temperature is to be at least +20 °C. The submersion tank must be designed and constructed so that every point in it can be easily seen. This is achieved by taking the following steps:

- the tank is to be painted a light color on the inside
- illumination is to be provided in the tank
- calibration oil is to be as clear as possible.

A water separator is to be provided in the compressed-air circuit.

2. Preparations for the seal test

The injection pump is to be drained of all calibration and lubricating oil before testing starts. All openings in the pump are to be closed-off, with the exception of the connection port for the delivery-valve holder. Suitable plugs are to be used for the oil-outlet ports in the drive-side bearing end plate. Remove the Robo diaphragms.

3. Seal testing

The seal test is applied to two areas of the pump:

- Suction gallery
- Camshaft chamber and spring chamber of the pump, and governor interior

Before submerging the pump in calibration oil, it is to be connected to the workshop compressed-air supply by means of a pressure-reducing valve with water separator. Fit the directional-control valve KDJE-P100/1 from the pressure-measurement device KDJE-P100 in the compressed-air inlet in order to carry out the specified pressure reduction during the leakage tests (Fig.). Now submerge the pump vertically in the test tank. The openings of the delivery-valve holder must not be covered with oil. Only rock the pump back and forth if it is necessary to localise the leak.

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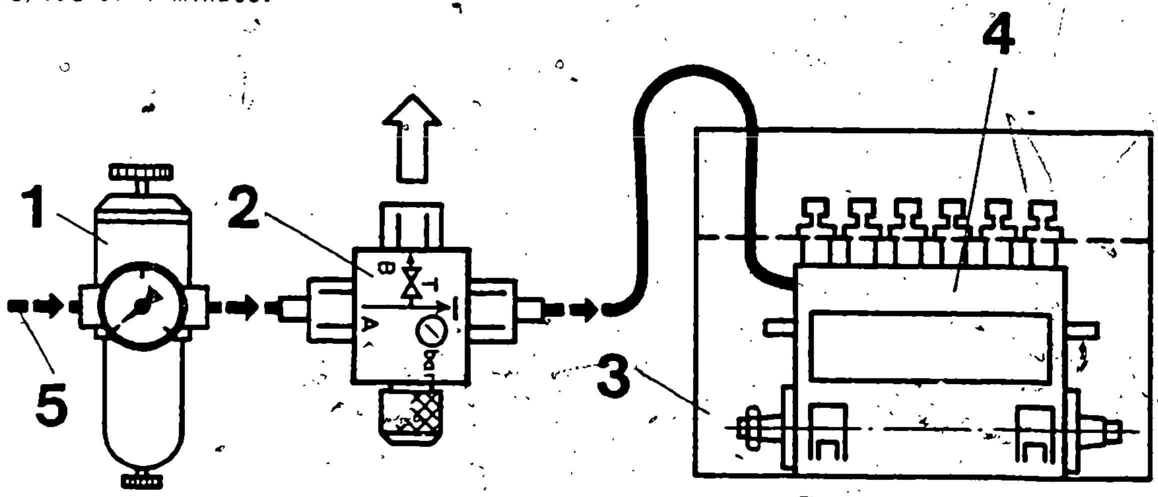
Suction gallery
Testing duration and testing pressure:

M- and A-pumps	4 minutes at 5 bar
MW-pumps	4 minutes at 5 bar, followed by 1 minute pulsation between 0 and 5 bar
P-pumps	8 minutes at 5 bar, followed by 1 minute pulsation between 0 and 5 bar
ZW(M) and CW-pumps	15 minutes at 5 bar.

Explanatory notes:

When seal-testing the M-, A-, and CW-pumps, increase the pressure once starting at 5 bar and then search for leaks.
When seal-testing the MW- and P-pumps, after 4 minutes have elapsed (8 minutes with the MW-pump) the pressure must be pulsed continuously between 0 and 5 bar for a period of 1 minute. This is due to the differences in the type of seals used. For the test, apply the appropriate pressure to the suction gallery of the pump by means of the directional-control valve KDJE-P 100/1 and two matching hoses.
The pulsating pressure is achieved by continuously opening and closing the screw plug for the vacant connection on the directional-control valve for a period of 1 minute.



1 = Pressure-reducing valve with pressure gauge 0...6 bar and water separator

2 = Directional-control valve KDJE-P 100/1

3 = Submersion tank containing calibration oil

4 = Fuel-injection pump

5 = Compressed air

Leaks are not permitted in the suction-gallery area. Particular attention is to be paid to the plunger-and-barrel assembly seats, and the O-ring seals, not leaking. The only exception are leaks between the plunger-and-barrel assembly cylinder and the plunger.

Camshaft chamber and spring chamber of the pump, and interior of the governor

The compressed air required for the seal tests is to be applied at a suitable point (e.g. oil-level check bore) to the pump camshaft chamber.

Test duration and test pressure:

M-, MW-, and A-pumps	3 minutes at 1.5 bar, followed by 1 minute at 0.5 bar
P-pumps	7 minutes at 1.5 bar, followed by 1 minute at 0.5 bar
ZW(M) and CW-pumps	30 minutes at 0.5 bar

Finally, a visual check is to be made that no leaks show at any of the sealing surfaces, screwed fittings, seal rings and closure capsules on the housing and end cover. No air bubbles must be visible.

In order to rule out the possibility of skin irritation, the personnel concerned with carrying out the test are to apply a skin-protection cream to their hands. After completion of the test, hands are to be washed with soap and water.

E6

E6

START-OF-DELIVERY SENSOR SYSTEM
for dynamic start-of-delivery testing
on in-line injection pumps

I-400/118 En
8.1984

Notes on how to set fuel-injection pumps on the injection-pump test bench

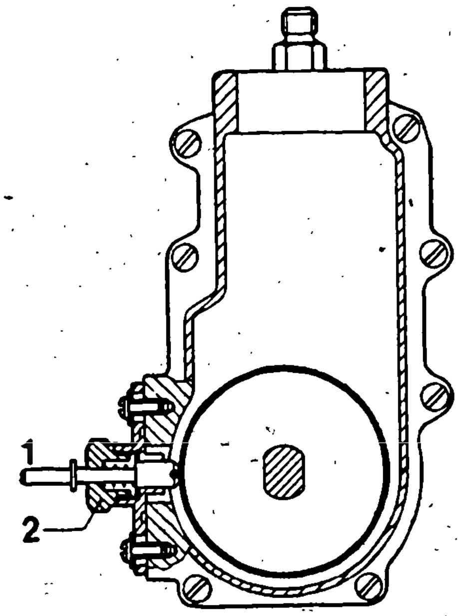
1. Mounting the sliding flange on fuel-injection pumps of series MW/RW

Set prestroke as before at outlet 1 in accordance with test specification and test start of delivery.

Then turn injection-pump camshaft further in the same direction of rotation by the value given in the test-specification sheet.

E7

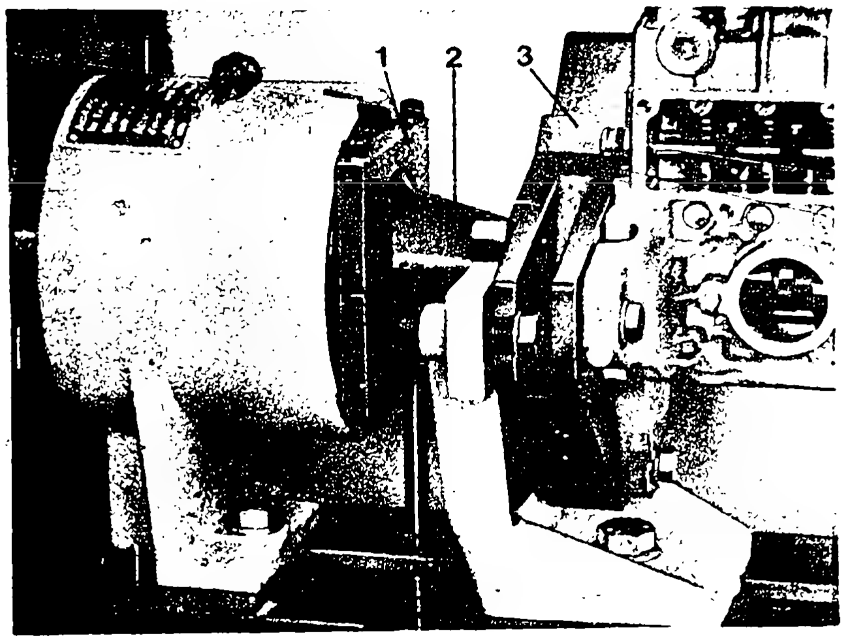
F6 E7



1 = Holding device KDEP 1077
2 = Union nut

For static basic timing of the injection pump to the engine, the flyweight capsule must be fixed precisely in this position with the aid of the sliding flange and holding device KDEP 1077.

Note:
It is essential to remove the holding device after mounting the pump on the engine and to replace it by screw plug.



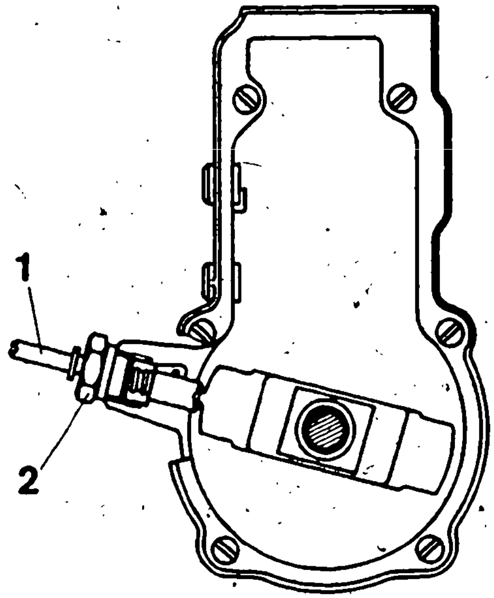
1 = Clamping device KDEP 1545
2 = Coupling half * 1 686 432 019
3 = Clamping flange * 1 685 720 208

2. Mounting flyweights on injection pumps of series M/RSF II

Set prestroke as before at outlet 1 in accordance with test specification and test start of delivery.

Then turn injection-pump camshaft further in the same direction of rotation by the value given in the test-specification sheet.
Mount clamping device KDEP 1545 on driving coupling so that the stay bolt is supported on the guide bed of the injection-pump test bench.

* These accessory parts are required for the M/RSF II pump in the Mercedes-Benz 190 D.



1 = Holding device KDEP-1077
2 = Union nut

Mount flyweight part on camshaft. Align flyweight according to the sensor bore and fix precisely in this position with holding device KDEP-1077. Mount fastening nut of flyweight and tighten to a preliminary tightening torque of 20 + 10 Nm.
Remove holding device KDEP 1077 and tighten fastening nut of flyweight to 50 - 60 Nm.
Remove clamping device KDEP 1545.
Caution:
Position of camshaft (according to test-specification sheet) must not change throughout the entire flyweight mounting process.

Note:
It is essential to remove holding device KDEP 1077 after mounting the pump on the engine and to replace it by screw plug.

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40...46, 58
VDT-I-401/103 En
9.1984

INSTRUCTIONS FOR ADJUSTING THE FULL LOAD FUEL DELIVERY ACCORDING TO ENGINE POWER CAPACITY ON FUEL-INJECTION PUMPS FOR KHD ENGINES F..M716

In the series pumps

PE 4P..LS99

PE 6P..LS89, ..LS111

PE 8P..LS48, ..LS114, ..RS115, ..LS177

PE 12P..LS90

with RSV.. or RSU(V).. controllers, the full load fuel delivery is set 20 min^{-1} lower than the pump nominal rotational speed (1/2 engine rotational speed).

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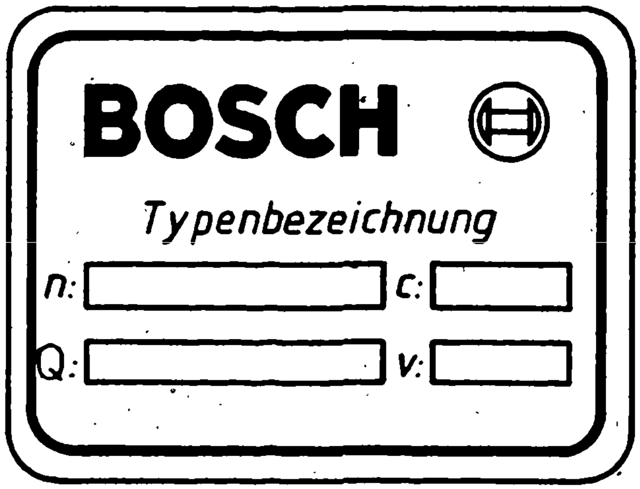
FM E12

Rotational speed limitation is adjusted in such a way that 10 min^{-1} above the nominal pump rotational speed draws the control rod out of the full load position.

<u>Exception:</u> A-output for ship propellers and pump drives. Here the full load fuel delivery is adjusted as follows:

Nominal pump rotational speed x 1.032 = setting speed for the full load delivery. The rotational speed limitation is set in such a way that 10 min^{-1} higher than the full load rotational speed pulls the control rod out of the full load position.



n = Pump rotational speed, min^{-1}
Q = Fuel-injection delivery per element in $cm^3/1000$ strokes

Additional data if compensation is built in:

c = Spring constant, kgf/mm
v = Spring preloading force, kgf
no field: Data for max. torque

For non-standard output-rotational speed combinations not contained in the table, the full load delivery and rotational speed have been stamped in on the controller nameplate.

Engine type, output, and rotational speed have been stamped in on the engine nameplate (see example at right).

Block "Type" (BF6M716) = type of engine
Block "HP, PS, CV" (B/300) = output class/power output (BHP)

F = outputs in column I

B - outputs in columns II, III and IV (Q1)

A - outputs in column IV (Q2) stationary operation (cranes, machinery

A - outputs in column IV (Q3) stationary operation (ship propellers a

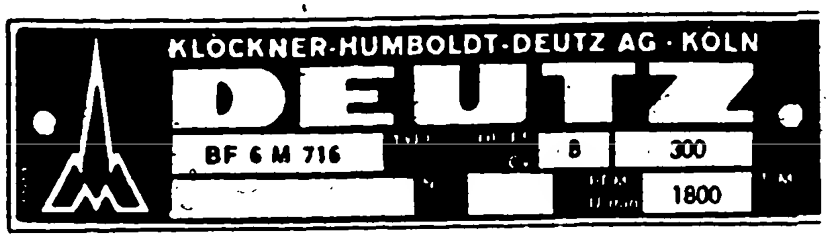
Block "rpm" (1800) = engine speed

Important information which must be obtained (not on nameplate)
Explanations for tables 1-4 in the column output group
without/with LLK = without/with charge-air cooler R = raw water cooling U = forced circ radiator

Tabular example for the output stamped on the nameplate:

Info. on engine nameplate			Setting of the fuel-injection pump (Q1 and Q2)	
Output		Rotation speed	Full load setting speed	Fuel delivery per table
	BHP	min^{-1}	min^{-1}	$cm^3/1000$ strokes
B	300	1800	$(\frac{1800}{2}) - 20 = 880$	$Q1 = 204 \pm 1$
A	300	1800	$(\frac{1800}{2}) - 20 = 880$	$Q2 = 214 \pm 1$
			Setting of the fuel-injection pump per the propeller law	
A	300	1800	$\frac{1800}{2} \times 1{,}032 = 929$	$Q3 = 210 \pm 1$

tional speed have been stamped in
example at right).



of engine
output class/power output (BHP)

in column I

in columns II, III and IV (Q1)

in column IV (Q2) stationary operation (cranes, machinery, and the like)

in column IV (Q3) stationary operation (ship propellers and pump-propeller law).

peed

ust be obtained (not on nameplate)
n the column output group
th charge-air cooler R = raw water cooling U = forced circulation cooling W = honeycomb

t stamped on the nameplate:

Setting of the fuel-injection pump (Q1 and Q2)

Full load setting speed min^{-1}	Fuel delivery per table cm^3/1000 strokes	Rotational speed limitation min^{-1}
$(\frac{1800}{2}) - 20 = 880$	Q1 = 204 ± 1	$(\frac{1800}{2}) + 10 = 910$
$(\frac{1800}{2}) - 20 = 880$	Q2 = 214 ± 1	$(\frac{1800}{2}) + 10 = 910$
Setting of the fuel-injection pump per the propeller law (Q3)		
$\frac{1800}{2} \times 1{,}032 = 929$	Q3 = 210 ± 1	$(\frac{1800}{2} \times 1{,}032) + 10 = 939$

Table 1

Setting values for Bosch fuel-injection pumps (size P)
Series F4M 716 - BF 8M 716

Testoil-ISO 4

Output group:				I						II					
Engine type				Outputs per DIN 700 29 Motor-vehicle and tractor engines Nameplate identification "F"						Pump setting values Non-overloadable, e pump For highly intermittent ope Nameplate identification "B					
Eng. (min^{-1}) →				2000		1900		1800		2000		1800		1500	
N(PS) Q (mm^3) →				N	Q	N	Q	N	Q	N	Q	N	Q	N	Q
F4M 716			a	133	125					140	125	128	130	110	136
			b												
F6M 716			a	200	126					210	176	192	129	165	135
			b												
BF6M 716	w/o LLK	O	a	260	172					275	173	260	183	220	160
			b												
	with LLK	U	a	295	185					320	190	300	197	258	186
			b												
		W	a	322	197					350	205	325	207	275	207
			b												
		R								362	210	335	209	285	218

E17

n

njection pumps (size P)

Testoil-ISO 4113

I					II								III					
utputs per DIN 700 29 otor-vehicle and tractor ngines ameplate identification "F"					Pump setting values for "B" outputs per DIN 6270 Non-overloadable, engines without fan or raw water pump For highly intermittent operation. Nameplate identification "B"								For intermittent operation. Nameplate identification "E					
00	1900		1800		2000		1800		1500		1200		1800		1500		1200	
Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q
125					140	125	128	130	110	136	88	136	121	119	105	127	84	12
													115	111				
126					210	126	192	129	165	135	132	131	180	117	158	125	126	12
172					275	173	260	183	220	160	176	162	250	175	210	156	168	15
185					320	190	300	197	258	186	200	186	285	192	248	176	190	17
197					350	205	325	207	275	207	220	213	312	205	262	191	210	19
					362	210	335	209	285	218	228	216	320	203	270	198	218	20

Table 1 (continued)
Setting value for Bosch fuel-injection pumps (size P)
Series F4M 716 - BF 8M 716

Testoil-ISO

Output group:				I						II					
				Outputs per DIN 700 20 Motor-vehicle and tractor engines (engines with fans) Nameplate identification "F"						Pump setting value for "B" Non-overloadable, engines w For highly intermittent ope Nameplate identification "B					
Eng. (min^{-1}) →				2000		1900		1800		2000		1800		1500	
N(PS) Q (mm³) →				N	Q	N	Q	N	Q	N	Q	N	Q	N	Q
F8M 716			a					240	125			250	123	215	130
			b												
BF8M 716	w/o LLK	O	a					320	188			335	184	295	164
			b				*	300	177			(335)	(187)	(286)	(162)
	with LLK	U	a									385	197	343	183
			b				*					(385)	(200)	(340)	(191)
		W	a									412	203	368	205
			b				*					(412)	(206)	(358)	(206)
		R										425	204	380	210
							*							(365)	(208)

* () Values for engines with 4-channel exhaust-gas turbochargers withou

~~EX8~~ E19

~~EX9~~ E20

ion pumps (size P)

Testoil-ISO 4113

I					II								III					
ts per DIN 700 20 -vehicle and tractor es nes with fans) late identification "F"					Pump setting value for "B" outputs per DIN 6270 Non-overloadable, engines without fan or raw water pump For highly intermittent operation. Nameplate identification "B"								For intermittent operation. Nameplate identification "B"					
	1900		1800		2000		1800		1500		1200		1800		1500		1200	
Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q
			240	125			250	123	215	130	172	126	240	129	205	119	165	116
			320	188			335	184	295	164	235	163	320	177	280	158	225	157
		*	300	177			(335)	(187)	(286)	(162)	(228)	(161)	(320)	(171)	(273)	(158)	(225)	(174)
							385	197	343	183	268	185	368	191	330	176	253	171
		*					(385)	(200)	(340)	(191)	(270)	(201)	(368)	(195)	(325)	(181)	(255)	(183)
							412	203	368	205	295	211	392	199	350	191	280	198
		*					(412)	(206)	(358)	(206)	(285)	(211)	(392)	(201)	(342)	(190)	(272)	(197)
							425	204	380	210	303	214	405	200	360	192	292	202
		*							(365)	(208)	(292)	(216)	(405)	(204)	(348)	(191)	(280)	(204)

engines with 4-channel exhaust-gas turbochargers without pulse converter (PC)

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E20

Table 2
Setting values for Bosch fuel-injection pumps (size P)
Series F 4 M 716 - BF 8M 716

Testoil-ISO

Output group:				IV												
Engine type				Pump setting values for "B" For continuous operation: Nameplate identification "B", for Continuous output "A" per DI Engines without fan or raw w Nameplate identification "A", 10% overloadable at n=constant apply. Nameplate identification "A", 10% overloadable according to pump setting values Q3 apply at pump rotational speed 1.032												
Eng. (min⁻¹) →				1800				1650				1500				
N(PS) Q (mm³) →				N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N
F4M 716			a	115	111	129	121	108	117	135	128	100	119	136	126	
			b													
F6M 716			a	172	109	127	117	162	111	131	123	150	115	135	126	1
			b													
BF6M 716	w/o LLK	O	a	235	161	182	175	218	165	181	176	200	153	160	159	
			b													
	with LLK	U	a	272	185	197	193	255	187	199	196	235	167	187	177	
			b													
		W	a	290	193	205	200	270	193	206	201	250	179	207	194	
			b													
		R	a	300	197	207	203	280	197	209	205	258	186	218	201	

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IV

Pump setting values for "B" outputs per DIN 6270

continuous operation: Nameplate identification "B", for this pump setting values Q1 apply.

Continuous output "A" per DIN 6270

Engines without fan or raw water pump

eplate identification "A", 10% overloadable at n=constant. For these, pump setting values Q2 ly.

eplate identification "A", 10% overloadable according to the propeller law. For these, c setting values Q3 apply at pump rotational speed 1.032 x $\frac{n}{2}$ engine.

1800			1650				1500				1200				1000			
1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3
11	129	121	108	117	135	128	100	119	136	126	80	110	136	124	66	111	125	120
09	127	117	162	111	131	123	150	115	135	126	120	108	131	120	100	107	121	116
61	182	175	218	165	181	176	200	153	160	159	160	151	162	158	130	154	171	164
85	197	193	255	187	199	196	235	167	187	177	182	165	186	181	145	175	189	185
93	205	200	270	193	206	201	250	179	207	194	200	185	213	201	160	187	199	197
97	207	203	280	197	209	205	258	186	218	201	208	188	217	207	165	189	202	198

Table 2 (continued)
Setting values for Bosch fuel-injection pumps (size P)
Series F 4 M 716 - BF 8M 716

Testoil-ISO

Output group:				IV												
Engine type				Pump setting values for "B" outputs per DIN 6270 For continuous operation: Nameplate identificaton "B" values Q1 apply. Continuous output "A" per DIN 6270 Engines without fan or raw water pump Nameplate identification "A", 10% overloadable at n=constant. setting values Q2 apply. Nameplate identification "A", 10% overloadable according to the For these, pump setting values Q3 apply at pump rotational spee												
Eng. (min⁻¹) →				1800				1650				1500				
N (PS) Q (mm³) →				N				N	Q1	Q2	Q3	N	Q1	Q2	Q3	N
F8M 716			a	225	107	121	115	215	112	131	125	200	115	132	127	1
			b													
BF8M 716	w/o LLK	C	a	300	162	182	177	282	162	163	174	268	155	164	159	2
			b	*(300)	(168)	(183)	(180)	(282)	(168)	(183)	(180)	(260)	(153)	(162)	(159)	(2
	with LLK	U	a	350	184	197	194	340	189	201	196	313	166	183	177	2
			b	*(350)	(189)	(200)	(196)	(340)	(192)	(204)	(200)	(310)	(171)	(192)	(184)	(2
		W	a	375	192	204	200	352	191	202	200	335	179	206	194	2
			b	*(375)	(196)	(206)	(203)	(352)	(196)	(209)	(204)	(325)	(178)	(206)	(194)	(2
		R	a	385	193	204	202	360	193	204	202	345	180	210	198	2
			b	*(385)	(198)	(208)	(205)	(360)	(199)	(212)	(208)	(332)	(180)	(208)	(198)	(2

* () Values for engine with 4-channel exhaust-gas turbochargers without pulse con

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Pump setting values for "B" outputs per DIN 6270

For continuous operation: Nameplate identificaton "B", for this pump setting values Q1 apply.

Continuous output "A" per DIN 6270

Engines without fan or raw water pump

neplate identification "A", 10% overloadable at n=constant. For these, pump tting values Q2 apply.

neplate identification "A", 10% overloadable according to the propeller law.

r these, pump setting values Q3 apply at pump rotational speeds 1.032 x $\frac{n}{2}$.

1800			1650				1500				1200				1000			
			N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q:
107	121	115	215	112	131	125	200	115	132	127	160	108	129	122	132	107	119	11(
162	182	177	282	162	163	174	268	155	164	159	215	152	162	159	175	158	175	15(
(168)	(183)	(180)	(282)	(168)	(183)	(180)	(260)	(153)	(162)	(159)	(208)	(151)	(161)	(158)	(170)	(158)	(173)	(16
184	197	194	340	189	201	196	313	166	183	177	245	164	186	177	193	173	187	18
(189)	(200)	(196)	(340)	(192)	(204)	(200)	(310)	(171)	(192)	(184)	(245)	(174)	(201)	(189)	(185)	(174)	(187)	(18
192	204	200	352	191	202	200	335	179	206	194	268	185	211	201	213	186	197	194
(196)	(206)	(203)	(352)	(196)	(209)	(204)	(325)	(178)	(206)	(194)	(260)	(184)	(212)	(203)	(205)	(187)	(199)	(19
193	204	202	360	193	204	202	345	180	210	198	278	191	216	209	220	188	201	197
(198)	(208)	(205)	(360)	(199)	(212)	(208)	(332)	(180)	(208)	(198)	(265)	(189)	(216)	(207)	(212)	(191)	(204)	(19

ne with 4-channel exhaust-gas turbochargers without pulse converter (PC)

Table 3
Setting values for Bosch fuel-injection pumps (size P)
Series F 12 M 716 - BF 16 M 716

Testoil-ISO

Output group:				I						II					
				Outputs per DIN 700 20 Motor-vehicle and tractor engines (Engines with fan) Nameplate identification "F"						Pump setting values fo Non-overloadable, engi For highly intermittent ope Nameplate identification "B					
Eng. (min⁻¹) →				2000		1900		1800		2000		1800		1500	
N(PS) Q (mm³) →				N	Q	N	Q	N	Q	N	Q	N	Q	N	Q
F12M 716			a	400	123			360	129	420	123	385	128	330	135
			b												
BF12M 716	w/o LLK	O	a	520	172					550	172	520	183	440	160
			b												
	with LLK	U	a	590	186					640	190	600	200	515	184
			b												
		W	a	644	197					700	206	650	209	550	207
			b												
		R								725	210	670	210	570	217

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I					II								III					
utputs per DIN 700 20 otor-vehicle and tractor ngines Engines with fan) ameplate identification "F"					Pump setting values for "B" outputs per DIN 6270 Non-overloadable, engines without fan or raw water pump													
					For highly intermittent operation. Nameplate identification "B"								For intermittent operation. Nameplate identification "B					
00	1900		1800		2000		1800		1500		1200		1800		1500		1200	
Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q
123			360	129	420	123	385	128	330	135	265	133	360	115	316	117	252	119
172					550	172	520	183	440	160	352	163	500	176	420	157	336	157
186					640	190	600	200	515	184	400	186	570	193	495	181	380	172
197					700	206	650	209	550	207	440	213	625	203	525	204	420	198
					725	210	670	210	570	217	455	216	640	203	540	195	435	201

Table 3 (continued)
Setting values for Bosch fuel-injection pumps (size P)
Series F 12 M 716 - BF 16 M 716

Testoil-ISO 4113

Output group:					I						II					
Engine type					Outputs per DIN 700 20 Motor-vehicle and tractor engine (Engine with fan) Nameplate identification "F"						Pump setting values for Non-overloadable, engine For highly intermittent opera Nameplate identification "B"					
Eng. (min⁻¹) →					2000		1900		1800		2000		1800		1500	
N (PS) Q (mm³) →					N	Q	N	Q	N	Q	N	Q	N	Q	N	Q
BF16M 716	w/o LLK	O	a										695	184	590	159
			b													
	with LLK	U	a										800	196	685	186
			b													
		W	a										865	204	735	195
			b													
		R											895	205	760	199

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ued)
njection pumps (size P)

Testoil-ISO 4113

I					II									III					
tputs per DIN 700 20 tor-vehicle and tractor gine ngine with fan) meplate identification "F"					Pump setting values for "B" outputs per DIN 6270 Non-overloadable, engines without fan or raw water pump														
					For highly intermittent operation. Nameplate identification "B"									For intermittent operation. Nameplate identification "B"					
2000	1900		1800		2000		1800		1500		1200			1800		1500		1200	
Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q		N	Q	N	Q	N	Q
							695	184	590	159	470	158		665	178	560	155	450	152
							800	196	685	186	535	177		760	189	660	171	505	166
							865	204	735	195	590	201		835	201	700	189	560	187
							895	205	760	199	605	204		855	202	720	193	585	197

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Table 4
Setting values for Bosch fuel-injection pumps (size P)
Series F 12 M 716 - BF 16 M 716

Testo

Output group:				IV											
Engine type				Pump setting values for "B" outputs For continuous operation: Nameplate identification "B", Q1 apply. Continuous output "A" per DIN 6270 Engines without fan or raw water pum Nameplate identification "A", 10% overloadable at n=cons setting values Q2 apply. Nameplate identification "A", 10% overloadable according For these, pump setting values Q3 apply at pump rotation											
Eng. (min^{-1}) ⟶				1800				1650				1500			
N(PS) Q (mm³) ⟶				N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3
F12M 716			a	345	109	128	117	325	111	131	125	300	112	135	127
			b												
BF12M 716	w/o LLK	O	a	470	162	182	177	436	167	183	179	400	153	160	158
			b												
	with LLK	U	a	545	186	200	196	510	187	199	196	470	167	185	177
			b												
		W	a	580	195	207	202	540	196	207	204	500	182	207	195
			b												
		R		600	198	208	205	560	197	209	205	515	186	215	202

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IV

Pump setting values for "B" outputs per DIN 6270

For continuous operation: Nameplate identification "B", for this pump setting values Q1 apply.

Continuous output "A" per DIN 6270

Engines without fan or raw water pump

Nameplate identification "A", 10% overloadable at n=constant. For these, pump setting values Q2 apply.
Nameplate identification "A", 10% overloadable according to the propeller law.

For these, pump setting values Q3 apply at pump rotational speeds 1.032 x $\frac{n}{2}$ engine.

1800			1650				1500				1200				1000			
Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3
109	128	117	325	111	131	125	300	112	135	127	240	107	133	125	200	106	121	116
162	182	177	436	167	183	179	400	153	160	158	320	151	163	158	260	152	170	164
186	200	196	510	187	199	196	470	167	185	177	365	166	187	180	290	174	188	185
195	207	202	540	196	207	204	500	182	207	195	400	185	213	201	320	187	199	195
198	208	205	560	197	209	205	515	186	215	202	415	187	217	207	330	189	200	197

Table 4 (continued)
Setting values for Bosch fuel-injection pumps (size P)
Series F 12 M 716 - BF 16 M 716

Testoil

Output group:				IV												
Engine type				Pump setting values for "B" outputs per DIN 6 For continuous operation: nameplate identification setting values Q1 apply Continuous output "A" per DIN 6270 Engines without fan or raw water pump Nameplate identification "A", 10% overloadable at n=const values Q2 apply. Nameplate identification "A", 10% overloadable according these, pump setting values Q3 apply at pump rotational sp												
Eng.(min⁻¹) →				1800				1650				1500				
N (PS) Q (mm³.) →				N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	
BF16M 716	w/o LLK	O	a	625	163	182	178	580	160	178	171	535	151	159	156	
			b													
	with LLK	U	a	730	186	198	197	680	185	197	193	625	163	187	173	
			b													
		W	a	775	192	202	200	720	189	201	197	670	171	196	186	
			b													
		R		800	195	203	202	750	194	206	201	690	173	199	188	

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F3

Pump setting values for "B" outputs per DIN 6270

For continuous operation: nameplate identification "B", for this pump setting values Q1 apply

Continuous output "A" per DIN 6270

Engines without fan or raw water pump

Nameplate identification "A", 10% overloadable at n=constant. For these, pump setting values Q2 apply.

Nameplate identification "A", 10% overloadable according to the propeller law. For these, pump setting values Q3 apply at pump rotational speeds 1.032 x $\frac{n}{2}$ engine.

1800			1650				1500				1200				1000			
Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3	N	Q1	Q2	Q3
163	182	178	580	160	178	171	535	151	159	156	430	149	160	154	350	151	167	162
186	198	197	680	185	197	193	625	163	187	173	490	162	179	171	385	164	183	178
192	202	200	720	189	201	197	670	171	196	186	535	174	201	190	425	180	193	190
195	203	202	750	194	206	201	690	173	199	188	555	179	206	197	440	184	196	191

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Table 4 continued)
Setting values for Bosch fuel-injection pumps (size P)
Series BF6M 716 - BF 16 M 716

Testoil-I

Output group:				II			
Engine type				Pump setting values for "B" outputs per DIN 6270 For highly intermittent operation Engines without fan or raw water pump Nameplate identification "B", non-overloadable Fuel-injection pump with plunger dia. 11 mm (PE..P110 A..)			
Eng. (min⁻¹) ⟶				1500		1800	
N (PS) Q (mm³) ⟶				N	Q	N	Q
with LLK	BF6M 716	W	a	300	233	350	230
			b	310	240	360	237
	BF8M 716	W	a	400	235	465	229
			b	415	244	480	237
	BF12M716	W	a	600	233	700	231
			b	620	240	720	239
	BF16M716	W	a	800	229	930	225
			b	830	238	960	234
			a				
			b				

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Pump setting values for "B" outputs per DIN 6270

For highly intermittent operation

Engines without fan or raw water pump

Nameplate identification "B", non-overloadable

Fuel-injection pump with plunger dia. 11 mm (PE..P110 A..)

00	1800	
Q	N	Q
233	350	230
240	360	237
235	465	229
244	480	237
233	700	231
240	720	239
229	930	225
238	960	234

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NOTES ON TESTING

VDT-I-420/115 En

3.1984

Supersedes VDT-I-DAF 004

ADJUSTING THE MANIFOLD-PRESSURE COMPENSATOR (LDA) ON THE FUEL INJECTION PUMP COMBINATIONS OF DAF-ENGINES DT 615, DF 615, DU 825

On the fuel-injection pump combinations as given above, the full-load deliveries are set as follows:

Remove the LDA and carry out the basic setting of the pump according to Section A, and of the governor according to Section B of the Test Specifications.

Fit the LDA

Set the full-load quantity (with charge-air pressure) using the full-load stop screw (3) in the housing of the manifold-pressure compensator.

At the speed given in the Test Specifications, set the manifold-pressure travel at the guide bushing of the helical spring (1) (spring seat).

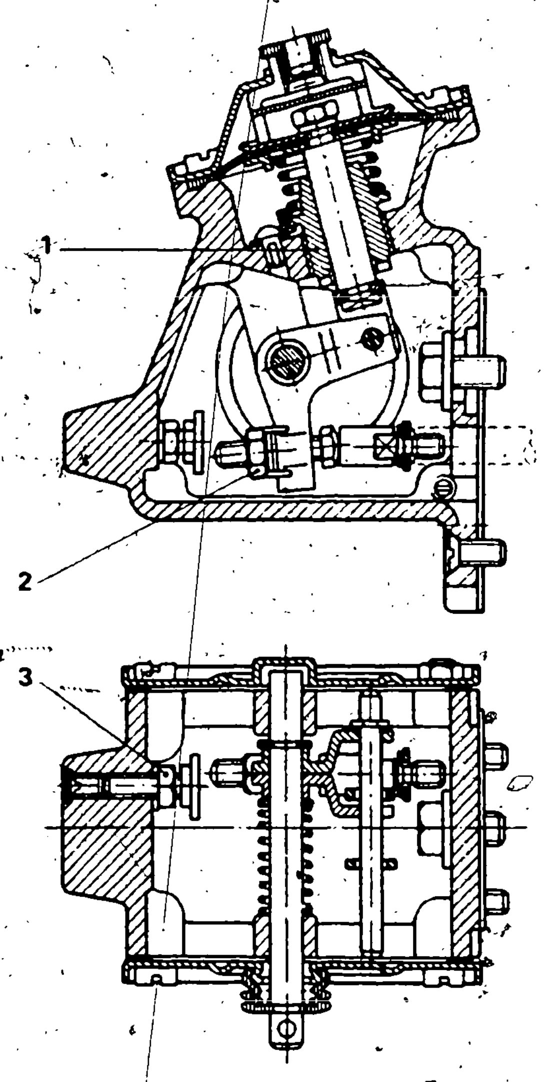
Using the bell crank (2) of the manifold-pressure compensator, set the full-load delivery at 0 bar.

Set 0.2...0.3 mm more control-rod travel at the fuel-delivery stop screw in the governor than is the case with charge-air pressure.

1 = Spring pre-tension (start and end of LDA travel)

2 = Setting (without charge-air pressure)

3 = Setting (with charge-air pressure)



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C80 Rk 77

After-sales Service Instructions

Testing

40
VDT-W-400/301 B
Ed. 1

Fuel-injection Pumps with Pneumatic Governor

Test Specification Form Sheet 3

BOSCH After-sales Service Automotive Equipment

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Contents

Note

With the introduction of modified tolerance data, Test Instruction Manual VDT-WPP 001/4 B employed in the past is being replaced on a section-by-section basis by new individual test instructions.

For this purpose new test specification form sheets apply and are identified by a number in a circle; this number is intended to indicate the particular governor type affected.

These test instructions for fuel-injection pumps with a pneumatic governor contain testing information for Test Specification Form Sheet ③.

Automotive Equipment Division After-Sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1

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(6. 76)

1. Test Port Closing, Set Plunger Lift to Port Closing, Test Angular Cam Spacing

Make the adjustment with the control rod travel for uniform delivery (value in box) unless expressly specified otherwise.

Correct in the
M-pump by tappet rollers of various thicknesses,
A-pump by shifting the tappet screws,
P-pump by shims.

1.1

Port closing is reached when the continuous flow of calibrating oil at the nozzle-holder assembly overflow pipe changes to droplets.

Plunger lift to port closing is the path (i.e., distance) in mm from the BDC position of the plunger to port closing.

Increase the feed pressure only until calibration oil emerges without bubbles at the open bleeder screw.

1.2 Angular Cam Spacing

At the specified plunger lift to port closing of plunger-and-barrel assembly 1, set the pointer on the graduated disc to a number favorable for the measurement.

Port closing of the other assemblies is set in each case, in the specified direction of rotation, according to the degrees of angular cam spacing as follows:

4 cylinders:
1 - 3 - 4 - 2, 90° ± 0.5° (± 0.75°) each,

6 cylinders:
1 - 5 - 3 - 6 - 2 - 4, 60° ± 0.5° (± 0.75°) each.

Abnormal cam sequences and angular cam spacings are given on the applicable test specification sheet.

The tolerance for **checking** is given in each case in brackets. These values apply for checking a pump in the condition it is in when received.

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2. Set Fuel Delivery
Section A of the Test Specification Sheet

The basic setting of the fuel delivery is considered as a pre-setting – uniform position of the plunger-and-barrel assemblies – in order to check the plunger/barrel and delivery-valve assemblies, and is made as a 100-stroke measurement.

The fuel delivery given in Column 3 is the average value for **all** plunger-and-barrel assemblies.

The fuel delivery difference given in Column 4 applies for the plunger-and-barrel assembly of **one** pump.

The control rod travel given in each case is set with the associated control rod travel measuring device, with the governor cover removed. Uniform delivery should be set according to the values in boxes.

Correction in
M-pumps at the control rod clamping piece,
A-pumps at the control sleeve gear,
P-pumps at the barrel-and-valve assembly.

The tolerance for **checking** is given in each case in brackets. These values apply for checking a pump in the condition it is in when received.

3. Governor Test
Section B of the Test Specification Sheet

3.1
The **leakage test** is made at the specified vacuum (Columns 2 . . 3): close the shutoff tap at the adjustment throttle. The drop in vacuum must lie within the specified values.

3.2 Control Rod Travel Limitation and Breakaway
Columns 4 . . 5

The control rod travel is limited at the full-load stop screw with the pump operating at the specified speed.
Breakaway (* in the test specification sheet) is reached by placing shims under the governor spring.

3.3. Test of Control Rod Travel
Columns 6 . . 7

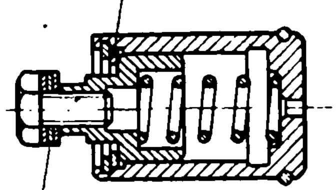
The test of the control rod travel (German: "RW") is carried out in the sequence of the vacuum data given by the test specification sheet.

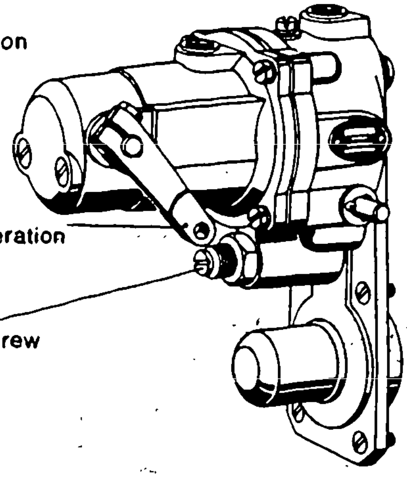
3.4 Torque Control
Columns 10 . . 11

If torque control begins at too low a vacuum, the initial compression of the torque-control spring must be reduced, i.e., thinner shims must be used between the torque-control spring and the spring bolt.

3.5 Supplementary Cam and Idle Stop
Columns 8 . . 9

Increase the vacuum from the value given in Column 4 (control rod travel limitation) to the second value given in Column 8 and press the supplementary cam **completely** over. Decrease the vacuum again to the point of control rod travel limitation (Column 4) and then measure both values in Columns 8 . . 9.
The difference in control rod travel between full-load and idle (Column 5 to Column 9, first value) must correspond with the data (** in the test specification sheet) given in Columns 7 . . 8 in Section C!
If this difference is not reached, the spring retainer must be changed accordingly: if the control rod travel is too large, remove shims (Item 49), and if the control rod travel is too small, add shims (Item 49).





4. Full-load Adjustment

Section C of Test Specification Sheet

4.1

The full-load control rod travel (Columns 1 . . 3) corresponds to the fuel delivery pre-set in Section A and to the control rod travel limitation set in Section B, Columns 4 . . 5.

The speed, vacuum, and fuel delivery given in Columns 1 . . 3 must be reached with the 1000-stroke measurement specified.

The **difference in fuel delivery** by the plunger-and-barrel assemblies in **one** pump given in Column 4 of Section A must be noted especially (10 times more in the 1000-stroke measurement)!

If necessary, correction in the
M-pump at the clamping piece,
A-pump at the control sleeve gear, and
P-pump at the barrel-and-valve assembly.

4.2 Fuel Delivery Characteristics

Columns 4 . . 6

Measure the fuel delivery at the vacuums and speeds specified.

Correction if fuel delivery too high: decrease the initial compression of the torque-control spring; if the fuel delivery is too low, increase the initial compression of this spring.

4.3 Imbalance among Cylinders at Idle

Columns 7 . . 8

At the speed and vacuum specified, the idle fuel delivery must be reached. The difference in fuel delivery given in Section A, Column 4, must be noted especially here!

If there are deviations in the difference in fuel delivery, a compromise must be found between fuel delivery characteristics at full-load and at idle. When making the 1000-stroke measurement in Section C, the values given in Section A are increased by a factor of 10.

The tolerance for **checking** is given in brackets in each case. These values apply for checking a pump in the condition it is in when received.

AFTER-SALES SERVICE ON FUEL-INJECTION PUMPS VDT-I-400/115 En
PE..ZW(M).. and PE..CW.. 6.1984
supersedes edition 4.1984

Fuel-injection pumps of size CW and some models of size ZW(M) cannot be tested on test bench EFEP 615 A.

Injection-pump test bench EPS 675 is required for testing and setting. This injection-pump test bench has not been introduced in the Bosch After-Sales Service Organization.

To enable after-sales service also on these injection pumps by the Bosch After-Sales Service Organization, we offer you the possibility of sending these injection pumps to us for repair, testing and setting.

After-sales-service workshops abroad should, if required, send the above-quoted injection pumps to the following address:

Robert Bosch GmbH
KH/LAV 2 - Auspackraum
zur Weiterleitung an
K 5 / QSG
Auf der Breit 4

D 7500 Karlsruhe 41

The injection pumps should be sent in postage paid. The delivery note must clearly show the scope of work to be performed. Please quote this Technical Bulletin on the delivery note. Except in the case of warranty damage for which we are responsible, the repair, testing and setting operations will be performed subject to payment.

BOSCH Geschäftsbereich KH Kundendienst Kraftfahrzeug-Ausrüstung.

F12

F12

Warranty procedure

During the warranty period defective components should be sent for warranty assessment through your national representative with warranty application G 21 and delivery note to:

Robert Bosch GmbH
KH / LAV 2 - Auspackraum
zur Weiterleitung an
K 5 / QSG
Auf der Breit 4

D 7500 Karlsruhe 1

Please quote this Technical Bulletin in plain text.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Register 40..., 46, 58
File Identity VDT-I-400/116 En
06.1986
Replaces edition of 6.84

FUEL-DELIVERY ADJUSTMENT IN SIZE P IN-LINE PUMPS INSTALLED ON SCANIA ENGINES

The Scania company retro-adjusts full-load delivery for higher or lower outputs on size P in-line pumps installed on engines in the series D8, DN8, DS8, DSI8, DS9, DSC9, DN11, DS11, DSI11, DSC11, DS14, DSC14, DSI14.

The pumps are designated with an additional letter after the pump's type designation, and in some cases after the assemblies part number. The corresponding test specifications are supplemented with a reference to this Technical Bulletin upon exchange.

The fuel-delivery setting values for the D11 engine are found on test sheet SCA11, On (see pertinent newest addition on microcard WP-..).

Note:
Adjustment of IP assemblies is permissible only insofar as it corresponds to the pump designation or description.

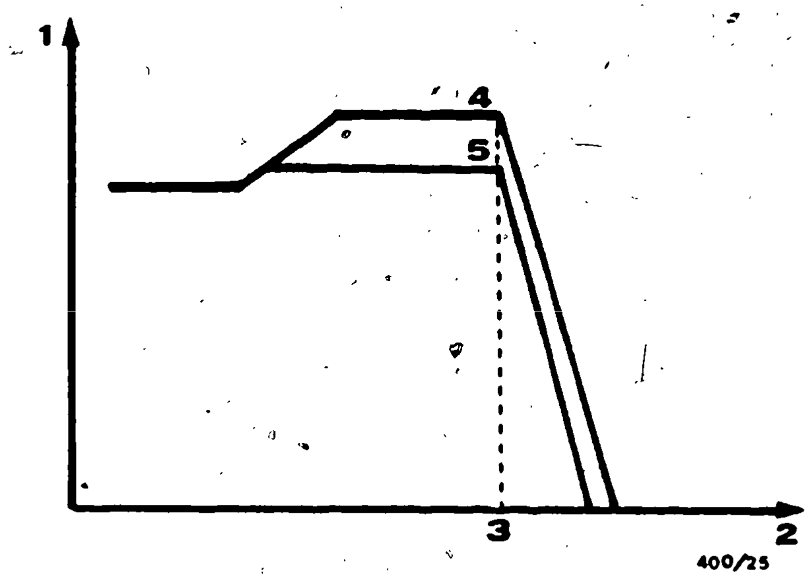
Use only the latest applicable test specifications on microcard WP... Other injection quantities can lead to engine damage and thus to damage claims on the part of engine or vehicle owners.

When ordering IP assemblies, assemblies are delivered only with the basic setting. This means that when replacing a designated injection pump, the corresponding fuel-delivery adjustment must be undertaken and the pump correspondingly marked.

For initial adjustment, always use the test specifications of the basic assembly without the final letter, in cases where no seperate test sheet is available. Afterwards undertake the required full-load-delivery correction.

F15

3.. 30 FAY T15



1 = Control-rod travel (mm)
2 = Engine speed n (min^{-1})
3 = Highest rated engine speed
4 = Full-load control-rod travel with manifold pressure
5 = Full-load control-rod travel without manifold pressure

If full-load control-rod travel (4) becomes less than full-load control-rod travel (5) due to fuel-delivery reduction, LDA adjustment is no longer necessary. The delivery quantities given in the tables have been compiled based on documentation from Saab-Scania.

Engine	Pump	Governor
D 8	PE 6 P 110 A 720 RS 261	RQV..170R, EP/RSV..310 R

Pump S261..	Delivery quantity in cm^3/1000 (± 1.0) at engine speed ..min^{-1} 1200	900	750	600	Cont.-rod-travel change with full-load change
X	84	81	78	72	- 0.7 mm
Z	80	75	71	64	- 1.2 mm
N	76	70	64	55	- 1.7 mm
M	71	63	57	48	- 2.3 mm
L	66	57	52	43	- 2.8 mm
K	60	52	46	37	- 3.3 mm
J	56	49	44	34	- 3.6 mm
I	51	46	41	31	- 3.9 mm

Test specifications apply to calibration oil per ISO-4113.

F17

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Engine	Pump	Governor
DNB 01	PE 6 P 110 A 720 RS 393	RQV200/1200 PA 224
		RQV250/1200 PA 469
		RQ 750 PA 528
		RQ 900 PA 528
		RSV833 110

Assy. no. 0 401 846 423, ..424, ..479, ..480
0 401 876 240

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1} 600	700	850	Cont.-rod-travel change with full-load change
S	83	91	95	- 0.3 mm
X	77	81	87	- 0.6 mm
Q	73	78	84	- 0.9 mm
Z	67	74	80	- 1.2 mm
O	64	71	78	- 1.4 mm
N	60	67	75	- 1.7 mm
M	55	62	70	- 2.1 mm
L	50	57	65	- 2.6 mm
K	46	52	60	- 3.0 mm
J	42	48	56	- 3.4 mm
I	38	45	51	- 3.8 mm

Test specifications apply to calibration oil eper ISO-4113.

FA T18

Engine	Pump	Governor
DS8.	PE 6 P 110 A 720 RS 3012	RQV .. 275 R
	PE 6 P 110 A 720 RS 3013	EP/RSV...310 R
	PE 6 P 110 A 720 RS 3034	RQV .. 275 R
	PE 6 P 110 A 720 RS 3035	EP/RSV...310 R

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1} 1200	900	750	600	Cont.-rod-travel change with full-load change
T	121	118	118	118	+ 0.3 mm
S	113	109	108	107	- 0.2 mm
X	109	105	102	101	- 0.5 mm
Q	106	102	99	97	- 0.7 mm
Z	102	98	94	91	- 1.0 mm
O	100	95	91	86	- 1.2 mm
N	96	92	87	80	- 1.5 mm
M	91	86	80	69	- 1.9 mm
L	86	81	74	60	- 2.3 mm
K	80	74	66	51	- 2.8 mm
J	77	71	63	46	- 3.1 mm
I	73	67	58	41	- 3.5 mm

Test specifications apply to calibration oil per ISO-4113.

F19

Engine	Pump	Governor
DS8 05,06	PE 6 P 110 A 720 RS	RQV 200-1200 PA 554
40	3034	RQV 200-1200 PA 554
DS8 05Kran	PE 6 P 110 A 720 RS	RQV 275-1200 PA 554-1
	3034 Z	RQV 250-1100 PA 657-4
		RSUV 833110
Assy. No. 0 401 876 715		RSV
0 401 846 733, ..770, ..790		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	117	- 0.2 mm
X	110	- 0.5 mm
Q	106	- 0.7 mm
Z	102	- 1.0 mm
O	98	- 1.2 mm
N	93	- 1.5 mm
M	85	- 1.9 mm
L	78	- 2.4 mm
K	72	- 2.8 mm
J	66	- 3.2 mm
I	60	- 3.6 mm

Test specifications apply to calibration oil per ISO-4113.

Engine	Pump	Governor
DS8 42	PE 6 P 110 A 720 RS 3076	RQ 750 PA 528 RQ 900 PA 528
Assy. No. 0 401 846 775, ..776		

Pump	Delivery quantity in cm^3/1000 (± 1.0) at engine speed ..min^{-1} 700	850	Cont.-rod-travel change with full-load change
Y	129	131	+ 0.5 mm
T	125	127	+ 0.3 mm
S	114	118	- 0.2 mm
X	107	112	- 0.5 mm
Q	103	108	- 0.8 mm
Z	96	103	- 1.1 mm
O	93	100	- 1.3 mm
N	88	96	- 1.5 mm
M	81	89	- 2.0 mm
L	75	83	- 2.4 mm
K	69	78	- 2.8 mm
J	63	71	- 3.2 mm
I	56	65	- 3.7 mm

Test specifications apply to calibration oil ISO-4113.

Engine	Pump	Governor
DSI8 01	PE 6 P 110 A 720 RS 3034	RQV 200-1200 PA 529
DSI8 01		529
Kran		RQV 275-1200 PA 529-1

Assy. no. 0 401 846 732,..791

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	126	- 0.2 mm
X	120	- 0.5 mm
Q	115	- 0.7 mm
Z	108	- 1.0 mm
O	104	- 1.2 mm
N	99	- 1.5 mm
M	90	- 2.0 mm
L	82	- 2.5 mm
K	75	- 2.9 mm
J	69	- 3.4 mm
I	63	- 3.8 mm

Test specifications apply to calibration oil per ISO-4113.

Engine	Pump	Governor
DS18 41	PE 6 P 110 A 720 RS 3076	RQ 750 PA 528-1 RQ 900 PA 528-2
Assy. No. 0 401 846 777, ..778		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	850	Cont.-rod-travel change with full-load change
S	129	131	- 0.2 mm
X	123	125	- 0.5 mm
Q	119	121	- 0.7 mm
Z	112	116	- 1.0 mm
O	106	111	- 1.3 mm
N	100	106	- 1.6 mm
M	92	99	- 2.0 mm
L	83	92	- 2.5 mm
K	76	85	- 3.0 mm
J	71	79	- 3.4 mm
I	65	73	- 3.8 mm

Test specifications apply to calibration oil per ISO-4113.

Engine	Pump	Governor
DS9 01	PE 6P 120A 320 RS 7102	RQV 200-1100 PA 712-1
03	PE 6P 120A 320 RS 7102	RQV 200-1100 PA 712
	PE 6P 120A 320 RS 7102	RQ 200/1000 PA 745

Assy. no. 0 402 746 800, ..822

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	160	- 0.1 mm
X	154	- 0.4 mm
Q	151	- 0.6 mm
Z	145	- 0.9 mm
O	140	- 1.1 mm
N	134	- 1.4 mm
M	126	- 1.9 mm
L	119	- 2.3 mm
K	112	- 2.7 mm
J	107	- 3.0 mm
I	102	- 3.3 mm
H	96	- 3.6 mm
G	91	- 3.8 mm

Test specifications apply to calibration oil per ISO-4113,
as well as calibrating nozzle-holder assembly 1 688 901 014
and test pressure line 1 680 750 015

En F23 F24

Engine	Pump	Governor
DSC9 01	PE 6 P 120 A 320 RS 7103	RQV 200-1100 712

Assy. no. 0 402 746 801

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	174	- 0.4 mm
X	168	- 0.9 mm
Q	164	- 1.2 mm
Z	158	- 1.6 mm
O	154	- 1.9 mm
N	146	- 2.4 mm
M	135	- 2.7 mm
L	126	- 3.7 mm
K	118	- 4.1 mm
J	112	- 4.4 mm
I	105	- 4.7 mm
H	99	- 5.0 mm
G	93	- 5.3 mm

Test specifications apply to calibration oil per ISO-4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test pressure line 1 680 750 015

F25

— F24 F25

Engine	Pump	Governor
DN11 01	PE 6 P 110 A 720 RS	RQV 250-1100 PA 468
04	3065	RQ 250/1100 PA 470
		RSV 350-1100 P1/481

Assy. no. 0 401 846 721, ..722, ..722 X
876 719

Pump	Delivery quantity in $cm^3/1000$ (± 1,0) at engine speed min^{-1}	Cont.-rod-travel change with full-load change
S	132	- 0.2 mm
X	126	- 0.5 mm
Q	122	- 0.7 mm
Z	117	- 1.0 mm
O	114	- 1.2 mm
N	111	- 1.4 mm
M	106	- 1.7 mm
L	99	- 2.1 mm
K	94	- 2.5 mm
J	89	- 2.8 mm
I	83	- 3.3 mm

Test specifications apply to calibration oil per ISO-4113.

F26

Engine	Pump	Governor
DN11 01	PE 6P 110A 720 RS 3115	RQV 200-1100 PA 468
Assy. no.	0 401 846 764, ..800	RQ 200/1100 PA 719
	0 401 876 728	RSV 350-1100 P1/481

Pump	Delivery quantity in cm^3/1000 (± 1.0) at engine speed ..min^{-1} 600	Cont.-rod - travel change with full-load change
S	113	- 0.3 mm
X	106	- 0.6 mm
Q	101	- 0.8 mm
Z	94	- 1.1 mm
O	91	- 1.3 mm
N	84	- 1.6 mm
M	75	- 2.0 mm
L	65	- 2.5 mm
K	58	- 2.9 mm
J	50	- 3.3 mm
I	45	- 3.7 mm

Test specifications apply to calibration oil per ISO-4113.

I-400/116

Engine	Pump	Governor
DN11 06	PE 6P 120A 720 RS 7001	RQV 200-1000 PA 612
		RQ 200/1000 PA 615
Assy. no. 0 402 646 807, ..808		200/1000 PA 615

Pump	Delivery quantity in cm 3/1000 (± 1.0) at engine speed ..min-1 600	Cont.-rod-travel change with full-load change
S	158	- 0.2 mm
X	152	- 0.6 mm
Q	137	- 0.8 mm
Z	130	- 1.1 mm
O	128	- 1.2 mm
N	122	- 1.5 mm
M	117	- 1.8 mm
L	109	- 2.2 mm
K	105	- 2.5 mm
J	102	- 2.8 mm
I	98	- 3.1 mm

Test specifications applies to calibration oil per ISO-4113 as well as calibrating nozzle-holder assembly 1 688 901 019 and test pressure line 1 680 750 015.

F28

F27 F28

Engine	Pump	Governor
DN11 40	PE 6P 120A 720 RS 7004	RQ 750 PA 528-2
		RQ 900 PA 528-2

Assy. no. 0 402 646 815, .. 814

Pump	Delivery quantity in cm³/1000 (± 1.0) at engine speed ..min⁻¹ 700	850	Cont.-rod-travel change with full-load change
S	152	159	- 0.2 mm
X	147	155	- 0.5 mm
Q	144	152	- 0.6 mm
Z	139	147	- 0.9 mm
O	136	143	- 1.1 mm
N	130	138	- 1.3 mm
M	123	130	- 1.7 mm
L	116	122	- 2.1 mm
K	109	116	- 2.4 mm
J	103	109	- 2.7 mm
I	98	103	- 3.0 mm

Test specifications apply to calibration oil per ISO-4113,
as well as
calibrating-nozzle assembly 1 688 901 019
and test pressure line 1 680 750 015.

G1

FZR G1

Engine	Pump	Governor
DS11	PE 6P 110A 720 RS 3006	RQV .. 242 R
	PE 6P 110A 720 RS 3016	EP/RSV.. 310 R
	PE 6P 110A 720 RS 3014	EP/RSV.. 310 R

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1} 1100	900	750	600	Cont.-rod-travel change with full-load change
P	198	202	202	204	+ 2.1 mm
U	188	189	188	192	+ 1.6 mm
R	183	185	184	187	+ 1.4 mm
W	178	178	178	181	+ 1.0 mm
V	175	175	174	177	+ 0.8 mm (Case-USA)
Y	170	170	169	171	+ 0.5 mm
T	168	167	166	167	+ 0.3 mm
S	158	159	158	159	- 0.2 mm
X	152	154	153	154	- 0.4 mm
Q	148	151	150	150	- 0.6 mm
Z	143	146	146	146	- 0.8 mm
O	139	142	142	142	- 1.0 mm
N	133	134	136	135	- 1.3 mm
M	124	125	127	126	- 1.7 mm
L	116	115	117	114	- 2.1 mm
K	108	106	105	102	- 2.5 mm
J	101	97	96	92	- 2.9 mm
I	94	90	88	85	- 3.4 mm

Test specifications apply to calibration oil per ISO-4113.

N° 04 G2

Engine	Pump	Governor
DS11	PE 6P 100A 720 RS 202	RQV..167 R, 168R
	PE 6P 100A 720 RS 203	EP/RSV..310 R

Pump	Delivery quantity in cm³/1000 (± 1.0) at engine speed ..min⁻¹ 1100	900	750	600	Cont.-rod-travel change with full-load change
W*	176	179	181	182	+ 0.9 mm
V*	172	174	176	176	+ 0.7 mm
Y*	168	170	172	171	+ 0.5 mm
T	165	166	168	164	+ 0.3 mm
S	156	157	157	152	- 0.2 mm
X	151	152	152	147	- 0.5 mm
Q	147	148	148	143	- 0.7 mm
Z	142	143	142	137	- 1.0 mm
O	138	139	137	133	- 1.2 mm
N	133	135	132	127	- 1.6 mm
M	124	125	122	116	- 2.1 mm
L	114	115	111	104	- 2.7 mm
K	104	105	100	93	- 3.2 mm
J	97	96	90	83	- 3.7 mm
I	89	86	80	73	- 4.3 mm

* Start of delivery with these variants at prestroke= 2.4...2.5 mm from BDC

Test specifications apply to calibration oil per ISO-4413.

Engine	Pump	Governor
DS11 01	PE 6P 110A 720 RS 3040	RQV 250-1100 PA 379R
		RQ 250/1100 PA 411R
DS11 11		
Assy. no. 0 401 846 710, ..717		

Pump	Delivery quantity in cm³/1000 (± 1.0) at engine speed ..min⁻¹ 600	Cont.-rod-travel change with full-load change
S	158	- 0.2 mm
X	153	- 0.5 mm
Q	150	- 0.6 mm
Z	144	- 0.9 mm
O	140	- 1.1 mm
N	132	- 1.5 mm
M	119	- 2.0 mm
L	107	- 2.5 mm
K	96	- 2.9 mm
J	86	- 3.3 mm
I	78	- 3.7 mm

Test specifications apply to calibration oil per ISO-4113.

G4

EC B3 G4

Engine	Pump	Governor
DS11 05	Case PE 6P 110 A 720 RS 3040	RSV 350-1100
DS11 05		P1/481
Assy. no. 0 401 876 720		

Pump	Delivery quantity in $cm^3/1000$ (± 1.0) at engine speed . min^{-1} 1100	Cont.-rod-travel change with full-load change
S	153	- 0.2 mm
X	147	- 0.5 mm
Q	140	- 0.8 mm
Z	134	- 1.1 mm

Test specifications apply to calibration oil per ISO-4113.

G5

64 G5

Engine	Pump	Governor
DS11 05 Case	PE 6P 110 A 720 RS 3040-1	RSV 350-1100
DS11 05		P1/505
Assy. no. 0 401 876 734		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 1100	Cont.-rod-travel change with full-load change
S	153	- 0.2 mm
X	147	- 0.5 mm
Q	140	- 0.8 mm
Z	134	- 1.1 mm

Test specifications apply to calibration oil per ISO 4113.

Engine	Pump	Governor
DS11 14	PE 6P 110 A 720 RS 3006	RQV 200-1100 PA 383 KR
Assy. no. 0 401 846 711		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 600	Cont.-rod-travel change with full-load change
S	170	- 0.3 mm
X	162	- 0.7 mm
Q	158	- 0.9 mm
Z	153	- 1.2 mm
O	150	- 1.3 mm
N	144	- 1.6 mm
M	132	- 2.2 mm
L	119	- 2.7 mm
K	107	- 3.2 mm
J	96	- 3.6 mm
I	86	- 4.0 mm

Test specifications apply to calibration oil per ISO-4113.

G7

Engine	Pump	Governor
DS11 14	PE 6P 110 A 720 RS 3040	RQV200-1000 PA555

Assy. no. 0 401 846 734

Pump	Delivery quantity in cm^3/1000 (± 1.0) at engine speed ..min^{-1} 600	Cont.-rod-travel change with full-load change
S	170	- 0.3 mm
X	162	- 0.7 mm
Q	158	- 0.9 mm
Z	153	- 1.2 mm
O	150	- 1.3 mm
N	144	- 1.6 mm
M	132	- 2.2 mm
L	119	- 2.7 mm
K	107	- 3.2 mm
J	96	- 3.6 mm
I	86	- 4.0 mm

Test specifications apply to calibration oil per ISO-4113.

Engine	Pump	Governor
DS11 14	PE 6P 110 A 720 RS 3040	RQV 200-1000 PA555-1
		RQV 275-1000 PA555-1
Assy. no. 0 401 846 763, ..795		

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	164	- 0.2 mm
X	158	- 0.5 mm
Q	154	- 0.7 mm
Z	148	- 1.0 mm
Ö	143	- 1.2 mm
N	137	- 1.5 mm
M	128	- 2.0 mm
L	118	- 2.5 mm
K	108	- 2.9 mm
J	99	- 3.4 mm
I	89	- 3.8 mm

Test specifications apply to calibration oil per ISO-4113.

G9

— 24 68 G9

Engine	Pump	Governor
DS11 15,18	PE 6P 120A 720 RS7001	RQV 250-1000 PA 539
DS11 15 Kran		200-1000 PA 539
		RQV 250-1050 PA 539
		200-1050 PA 539
		RQ 250/1000 PA 616
		200/1000 PA 616
		RQV 275-1000 PA 539-4
Assy. no. 0 402 646 801, ..802, .. 809		
0 402 646 817		

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed..min^{-1} 700	Cont.-rod-travel change with full-load change
S	195	- 0.2 mm
X	185	- 0.6 mm
Q	180	- 0.8 mm
Z	173	- 1.1 mm
O	169	- 1.3 mm
N	162	- 1.6 mm
M	153	- 2.0 mm
L	143	- 2.5 mm
K	135	- 2.9 mm
J	126	- 3.4 mm
I	119	- 3.8 mm

Test specifications apply to calibration oil per ISO-4113, as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

G10

Engine	Pump	Governor
DS11 25,26	PE 6P 120A 720 RS 7001	RQ200/1100 PA 713

Assy. no. 0 402 646 819

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
V	177	+ 0.7 mm
Y	171	+ 0.5 mm
T	167	+ 0.3 mm
S	159	- 0.1 mm
X	153	- 0.4 mm
Q	149	- 0.5 mm
Z	144	- 0.8 mm
O	141	- 0.9 mm
N	136	- 1.1 mm
M	129	- 1.5 mm
L	122	- 1.9 mm
K	116	- 2.3 mm
J	110	- 2.6 mm
I	104	- 3.0 mm
H	98	- 3.4 mm
G	93	- 3.7 mm

Test specifications apply to calibration oil per ISO-4113, as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

Engine	Pump	Governor
DS1140,41,42	PE 6P 120A 720RS 7001	RSV 350-1100P 1/481
DSI11 40,44		
Assy. no. 0 402 676 800		

Pump	Delivery quantity in cm³/1000 (± 1.0) at engine speed ..min⁻¹ 700	Cont.-rod-travel change with full-load change
U	242	+ 1.9 mm
R	235	+ 1.6 mm
W	228	+ 1.3 mm
V	221	+ 1.0 mm
Y	215	+ 0.7 mm
T	208	+ 0.4 mm
S	195	- 0.2 mm
X	185	- 0.6 mm
Q	180	- 0.8 mm
Z	173	- 1.1 mm
O	169	- 1.3 mm
N	162	- 1.6 mm
M	153	- 2.0 mm
L	143	- 2.5 mm
K	135	- 2.9 mm
J	126	- 3.4 mm
I	119	- 3.8 mm

Test specifications apply to calibration oil per ISO-4113, as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

G12

Engine	Pump	Governor
DS11 43,44 45	PE 6P 120A 720 RS 7004	RQ 750 PA 528 RQ 900 PA 528
DSI11 42, 45		RQ1050 PA 528
Assy. no. 0 402 646 803, ..804, ..805		

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speeds ..min^{-1} 700	850	1000	Cont.-rod-travel change with full-rod change
U	257	264	264	+ 2.1 mm
R	251	255	255	+ 1.8 mm
W	240	241	242	+ 1.3 mm
V	233	231	234	+ 1.0 mm
Y	224	221	226	+ 0.6 mm
T	217	215	221	+ 0.3 mm
S	204	206	211	- 0.2 mm
X	197	199	206	- 0.5 mm
Q	192	194	202	- 0.7 mm
Z	184	189	197	- 1.0 mm
O	179	184	193	- 1.2 mm
N	171	178	187	- 1.5 mm
M	159	168	176	- 2.0 mm
L	152	160	168	- 2.4 mm
K	142	150	157	- 2.9 mm
J	134	142	148	- 3.3 mm
I	127	134	139	- 3.7 mm

Test specifications apply to calibration oil ISO-4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test pressure line 1 680 750 015.

G13

A02 G12 G13

Engine	Pump	Governor
DSC11 01	PE 6P 120A 720 RS 7007	RQV 200-1000 PA 539-2
02		RQV 275-1100 PA 539-5
Assy. no. 0 402 646 812, ..818		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
T	220	+ 0.8 mm
S	205	- 0.4 mm
X	196	- 1.1 mm
9	191	- 1.6 mm
Z	183	- 2.1 mm
O	178	- 2.5 mm
N	172	- 3.0 mm
M	161	- 3.7 mm
L	152	- 4.3 mm
K	143	- 4.8 mm
J	135	- 5.3 mm
I	127	- 5.7 mm

Test specifications apply to calibration oil per ISO-4113,
as well as
calibrating nozzle-holder assembly 1 688 901 019
and test presssure line 1 680 750 015.

Engine	Pump	Governor
DSC11 01, 02	PE 6P 120 A 720 RS 7104	RQV 200-1000 PA 725

Assy. no. 0 402 646 821

Pump	Delivery quantity in cm^3/1000 (± 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
T	220	+ 0.8 mm
S	205	- 0.4 mm
X	197	- 1.1 mm
Q	192	- 1.6 mm
Z	185	- 2.1 mm
O	180	- 2.5 mm
N	174	- 3.0 mm
M	164	- 3.7 mm
L	156	- 4.3 mm
K	148	- 4.8 mm
J	141	- 5.3 mm
I	134	- 5.7 mm

Test specifications apply to calibration oil per ISO-4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test pressure line 1 680 750 015.

G10 G14 G15

Engine	Pump	Governor
DC 11 03 06	PE 6P 120 A 720 RS 7015	RQV 200-1000 PA 768
Assy. no. 0 402 646 828		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.- rod-travel change with full-load change
S	213	- 0.3 mm
X	204	- 0.6 mm
Q	199	- 0.9 mm
Z	190	- 1.2 mm
O	184	- 1.5 mm
N	175	- 1.8 mm
M	159	- 2.5 mm
L	148	- 3.0 mm
K	138	- 3.5 mm
J	129	- 4.0 mm
I	121	- 4.4 mm

Test specifications apply to calibration oil ISO-4113,
as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 01	PE 8P 110A 920/4LS 3020	RQV 250-1000 PA 306/2 R
Assy. no. 0 401 848 717		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 1000	Cont.-rod-travel change with full-load change
X	154	- 0.5 mm
Z	145	- 1.1 mm
M	127	- 2.1 mm

Test specifications apply to calibration oil per ISO-4113.

Engine	Pump	Generator
DS 14 06, 07	PE 8P 120A 920/4LS7002	RQV 250-1050 PA 547
DS 14 06 Kran		
N0m.conj. 0 402 648 802.		

Pump	Delivery quantitiy in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm
O	159	- 1.3 mm
N	153	- 1.6 mm
M	145	- 2.1 mm
L	137	- 2.6 mm
K	131	- 3.0 mm
J	122	- 3.5 mm
I	114	- 4.0 mm

Test specifications apply to calibration oil per ISO-4113, as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

Engine	Pump	Generator
DS 14 06, 07	PE 8P 120A 920/4LS7002	RQV 275-1000 PA
DS 14 06 Kran		547-3
Assy. No. 0 402 648 810		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm
O	159	- 1.3 mm
N	153	- 1.6 mm
M	145	- 2.1 mm
L	137	- 2.6 mm
K	131	- 3.0 mm
J	122	- 3.5 mm
I	114	- 4.0 mm

Test specifications apply to calibration oil per ISO-4113, as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 06, 07	PE 8P 120A 920/4LS 7002	RQV 250-1000 PA547
DS 14 06 Kran		
Assy. no. 0 402 648 801		

Pump	Delivery quantity in cm³/1000 (± 1.0) at engine speed ..min⁻¹ 700	Cont.-rod-travel change with full-load change
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm
O	159	- 1.3 mm
N	153	- 1.6 mm
M	145	- 2.1 mm
L	137	- 2.6 mm
K	131	- 3.0 mm
J	122	- 3.5 mm
I	114	- 4.0 mm

Test specifications apply to calibration oil per ISO-4113,
as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 42	PE 8P 120A 920/4LS 7002-1	RSV 350-1050 P1/504

Assy. no. 0 402 678 801

Pump	Delivery quantity in cm³/1000 (± 1.0) at engine speed ..min⁻¹ 700	Cont.-rod-travel change with full-load change
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm

Test specifications apply to calibration oil per ISO-4113, as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

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Engine	Pump	Generator
DSC14 01,02	PE 8P 120 A 920/4LS	RQV 200-950 PA 547-1
DSC14 01 Kran	7008	RQV 275-900 PA 547-4
	..7008X	RQV 200-950 PA 547-1
	..7108	RQV 200-950 PA 736

Assy. no. 0 402 648 807, ..811, ..813, ..815

Pump	Delivery quantity in cm^3/1000 (± 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
S	196	- 0.4 mm
X	188	- 1.1 mm
Q	183	- 1.5 mm
Z	176	- 2.0 mm
O	172	- 2.3 mm
N	165	- 2.8 mm
M	156	- 3.4 mm
L	148	- 3.9 mm
K	140	- 4.3 mm
J	128	- 4.7 mm
I	126	- 4.9 mm

Test specifications apply to calibration oil per ISO-4113, as well as
calibrating nozzle-holder assembly 1 688 901 019
and test pressure line 1 680 750 015.

Engine	Pump	Generator
DS 14 40,42	PE 8P 120 A 920/4 LS 7002	RSV 350-1100
DSI14 40,41		P 1/484
Assy. no. 0 402 678 800		

Pump	Delivery quantity in $cm^3/1000$ ($\pm$ 1.0) at engine speed ..min^{-1} 700	Cont.-rod-travel change with full-load change
U	229	+ 1.9 mm
R	224	+ 1.6 mm
W	218	+ 1.3 mm
V	210	+ 1.0 mm
Y	204	+ 0.7 mm
T	195	+ 0.4 mm
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm
O	159	- 1.3 mm
N	153	- 1.6 mm
M	145	- 2.1 mm
L	137	- 2.6 mm
K	131	- 3.0 mm
J	122	- 3.5 mm
I	114	- 4.0 mm

Test specifications apply to calibration oil per ISO-4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test pressure line 1 680 750 015.

I-400/116

Engine	Pump	Generator
DS 14 41	PE 8P 120 A 920/4 LS7003	RQV 750 PA 528
DSI14 42,43		RQV 900 PA 528
Assy. no. 0 402 648 803, ..804, ..805		RQV1050 PA 528

Pump	Delivery quantity in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1} 700	850	1000	Cont.-rod-travel change with full-load change
U	246	241	243	+ 2.1 mm
R	238	235	237	+ 1.8 mm
W	231	227	231	+ 1.5 mm
V	223	219	224	+ 1.2 mm
Y	214	210	216	+ 0.8 mm
T	205	204	210	+ 0.4 mm
S	183	183	194	- 0.2 mm
X	179	180	190	- 0.4 mm
Q	173	177	187	- 0.6 mm
Z	165	171	180	- 0.9 mm
O	160	166	175	- 1.1 mm
N	154	161	170	- 1.4 mm
M	147	154	162	- 1.8 mm
L	140	147	154	- 2.2 mm
K	134	139	145	- 2.6 mm
J	126	132	137	- 3.0 mm
I	121	125	128	- 3.4 mm

Test specifications apply to calibration oil per ISO-4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test pressure line 1 680 750 015.

G24

→ ~~G23~~ G211

C16

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G25

F2 G24 G25

40...46,58

VDT-I-400/117 En

7.1984

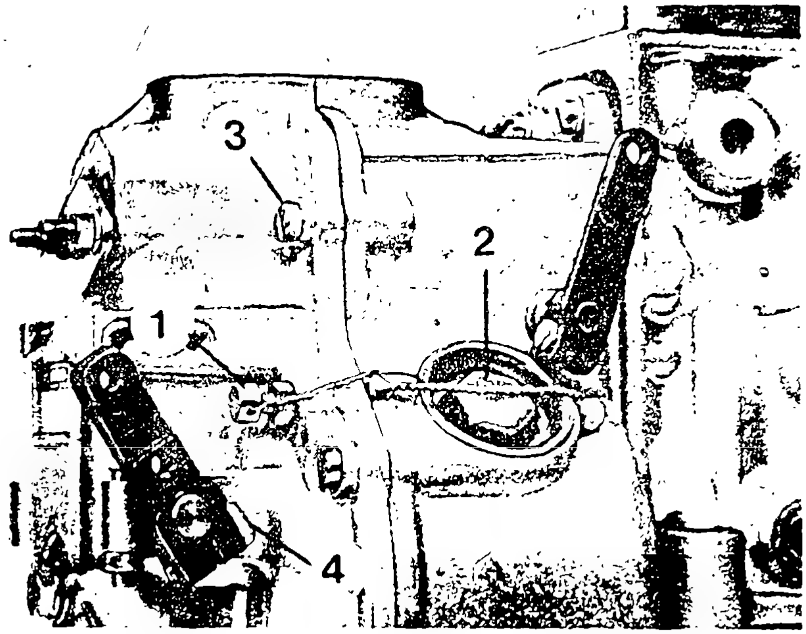
SEALING INSTRUCTIONS FOR
PE..P..FUEL-INJECTION PUMPS
ON SCANIA ENGINES

Size P in-line injection pumps on Scania engines must be sealed as described in the following after repairing and/or setting on the injection-pump test bench.

1 Technical Bulletin

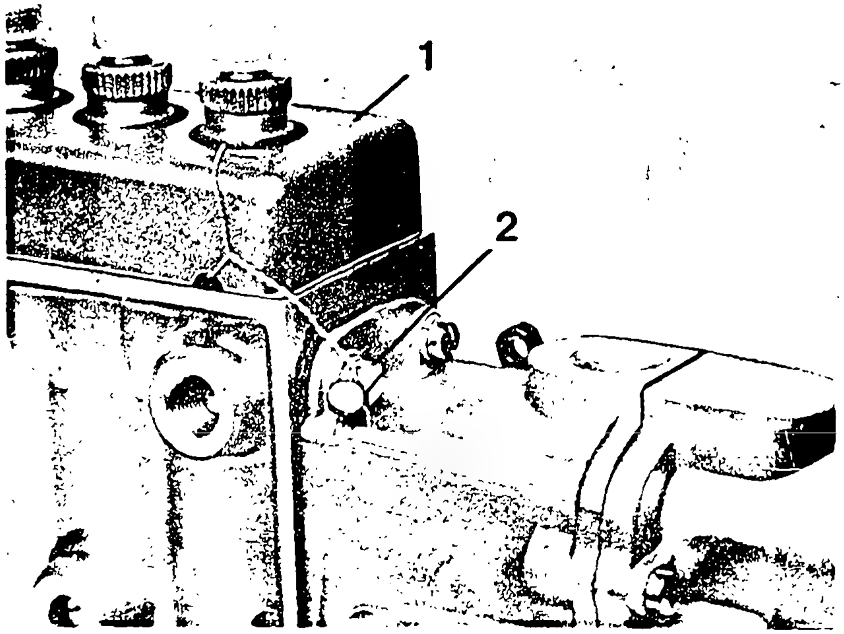
BOSCH Geschäftsbereich KH Kundendienst Kraftfahrzeug-Ausrüstung

535 G26

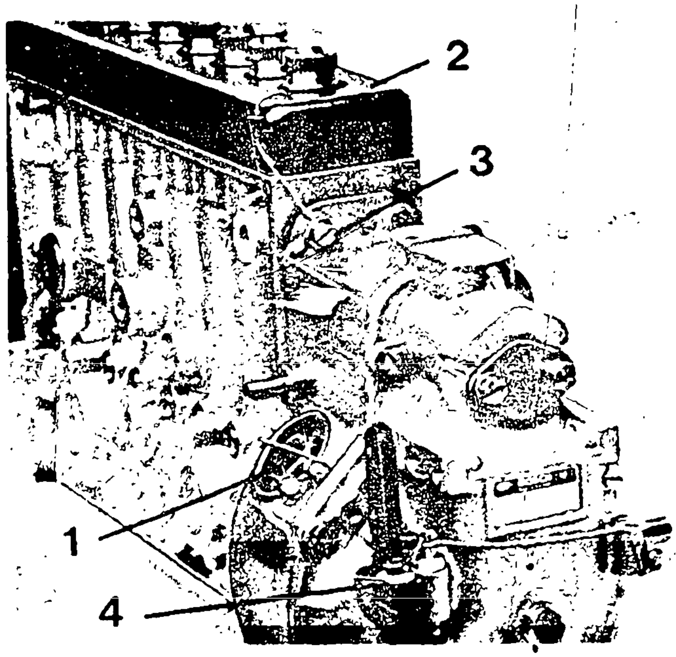


Wire sealing of maximum-speed stop screw (1) and governor spring mounting bore screw plug (2) with the governor housing on 6-cylinder pumps.

Paint sealing with yellow sealing paint of governor cover fastening screw (3) on 6- and 8-cylinder pumps, and of clamping screw (4) for speed-control lever on 6-cylinder pumps.

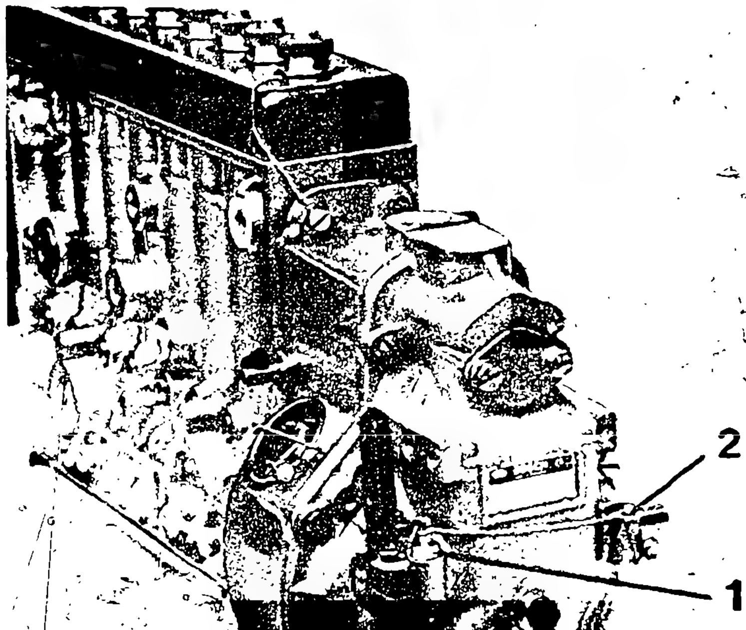


Wire sealing of pump housing cover (1) with governor housing fastening screw (2) on 6-cylinder pumps.



Wire sealing of governor spring mounting bore screw plug (1) with the governor housing and of pump housing cover (2) with governor housing fastening screw (3) on 8-cylinder pumps.

Paint sealing with yellow sealing paint of clamping screw (4) of the speed-control lever on 8-cylinder pumps.



Wire sealing of maximum-speed stop screw (1) with governor cover (2) on 8-cylinder pumps.

H2

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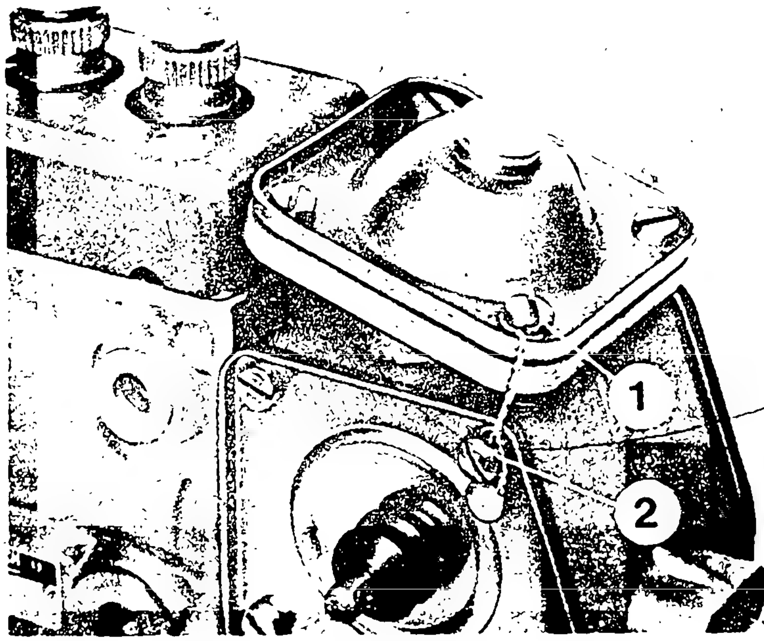
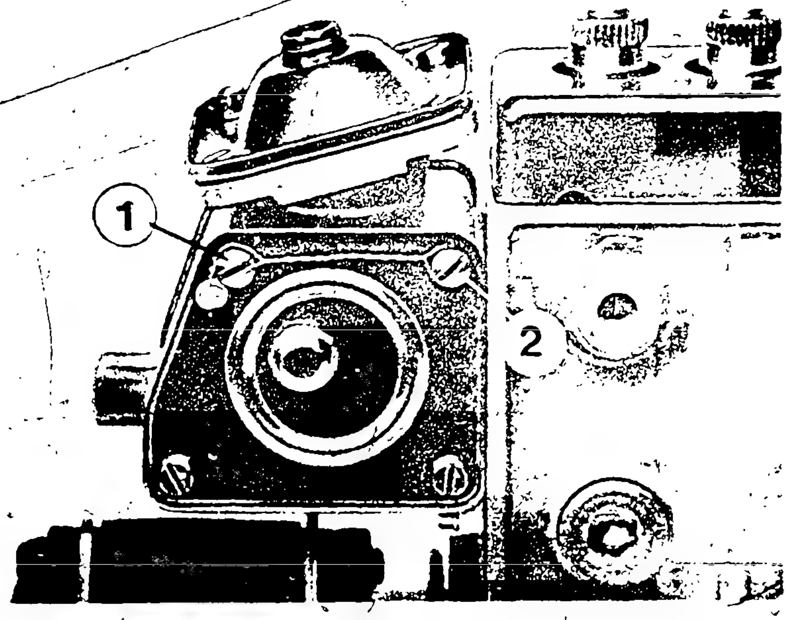


Wire sealing of manifold-pressure compensator cover fastening screw (1) with manifold-pressure compensator housing cover fastening screw (2) on 6-and 8-cylinder pumps.

I-400/117



Wire sealing of two manifold-pressure compensator housing cover fastening screws (1 and 2) on 6- and 8-cylinder pumps.

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H4

FB H11

Register 40...46, 58
File Identity VDT-I-400/122 En
8.1986

SETTING OF INJECTED FUEL QUANTITY FOR IN-LINE PUMPS, SIZE P, BUILT ON TO SCANIA ENGINES

In Technical Bulletin VDT-I-400/116, 06.1986 edition, the test nozzle-and-holder assembly

1 688 901 014

is specified on page 11 for setting the quantity of fuel injected by electric fuel-pump assemblies

0 402 746 800
and 0 402 746 822.

This information is incorrect.

Use test nozzle-and-holder assembly

1 688 901 019.

Please correct this in Technical Bulletin VDT-I-400/116.

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H5

FH H5

Register 40...46, 55
File Identity VDT-I-410/107 En
7. 1986
(supersedes Ed. 6. 1984)

SETTING OF FUEL-INJ. PUMPS

PE..P.. WITH TORQUE-CONTROL

DELIVERY VALVES

On in-line pumps of size P with torque-control delivery valves (perforated valves), the value for the fuel-delivery characteristics given in the test specifications for various injection-pump assemblies for Saab-Scania can be set only by limiting the valve stroke.

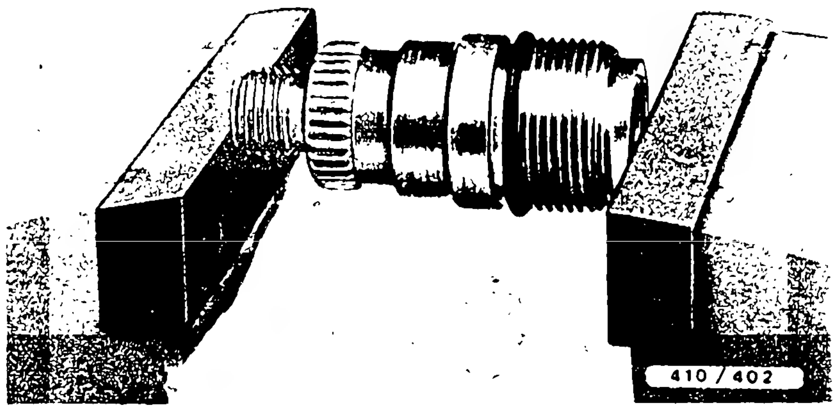
This limitation of the valve stroke is possible by selecting the necessary filler piece in the delivery-valve holder. The filler pieces differ from each other in their length.

The filler pieces are grouped together in the service-parts lists for the injection pumps as a selection group 2 413 121 900 with the following distinguishing features:

Part no.	Overall length (mm)	Features
2 413 121 013	15.7	----
2 413 121 027	15.8	Zinc-coated and chromated (blue)
2 413 121 028	15.9	Zinc-coated and chromated (yellow)
2 413 121 029	16.0	Half-mat black-pickled
2 413 121 030	16.1	Mat phosphated
2 413 121 031	16.2	Copper-plated
2 413 121 033	15.6	1 identification groove on stem
2 413 121 034	15.5	2 identification grooves on stem

HS 116

H6

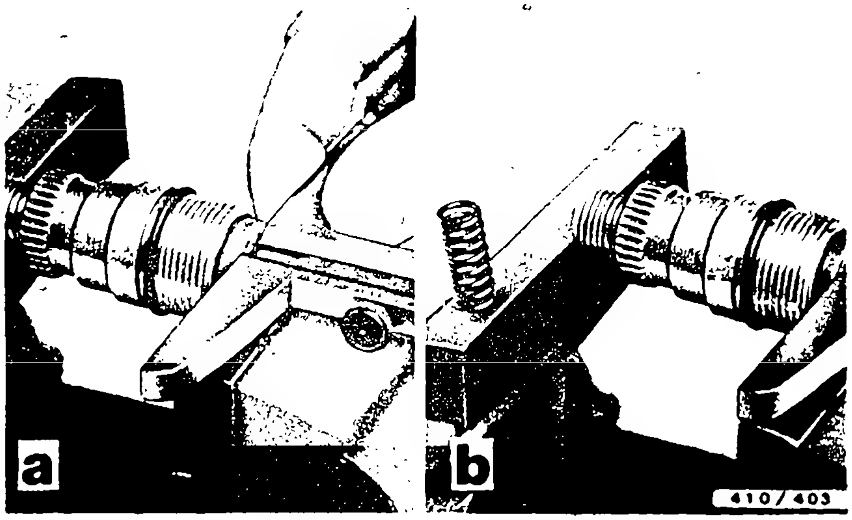


If setting on the test bench is preceded by a repair of the pump, measure the valve stroke in the following manner:

Clamp in the vise the complete delivery-valve assembly consisting of:
* Delivery-valve holder
* Filler piece
* Delivery-valve spring
* Seal ring
* Complete delivery valve.

To prevent damage to delivery-valve holder and delivery valve, be sure to use protective jaws or ground vise jaws.

A6 117



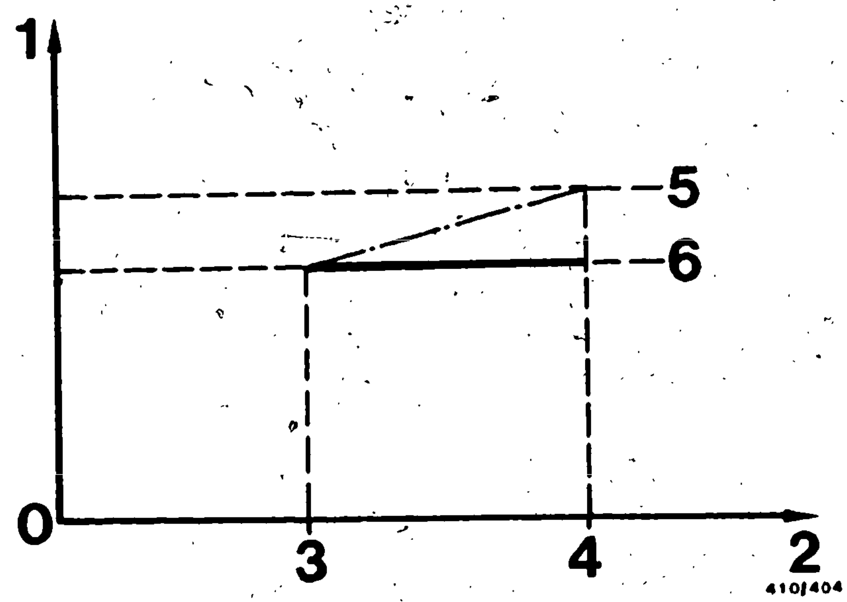
Using a depth gauge, measure the distance between the end face of the delivery-valve holder and the end face of the delivery-valve cone (picture a).
Remove delivery-valve spring from delivery-valve assembly and clamp the latter once again in the vise. Using the slide of the gauge, bring the delivery-valve cone into contact with the filler piece in the delivery-valve holder and measure the distance between the delivery-valve holder and the valve cone (picture b). From this distance subtract the previously measured distance (with valve spring). The difference is the valve stroke. If the calculated valve stroke does not agree with the minimum stroke specified in the following table, replace the filler piece in the delivery-valve holder by another one of appropriate length.
If only the fuel delivery is being tested on injection pumps, it is necessary to replace the filler piece only if this becomes necessary by measuring the delivery and the valve stroke.

Set the following allowable minimum-valve stroke:

Pump designation		Valve stroke
PE 6P 110 A 720	RS 393	2.3 mm
PE 6P 110 A 720	RS 3006	2.9 mm
PE 8P 110 A 920/4	RS 3020	2.3 mm
PE 6P 110 A 720	RS 3034	2.9 mm
PE 6P 110 A 720	RS 3040	2.3 mm
PE 6P 110 A 720	RS 3065	2.3 mm
PE 6P 110 A 720	RS 3115	2.3 mm

NP 119

H9



1 = Fuel delivery Q (cm^3/1000 strokes)
2 = Pump speed (min^{-1})
3 = Full-load speed 1 (min^{-1})
4 = Full-load speed 2 (min^{-1})
5 = Fuel delivery with long filler piece
6 = Fuel delivery with short filler piece

The fuel-delivery characteristics of the injection pump are influenced by the length of the filler piece as follows (see diagram):

The longer the filler piece, the smaller the valve stroke and the greater the fuel delivery at high speed.

The stroke must not fall below the minimum allowable, since otherwise the relief collar will not come out of the valve holder.

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~~H12~~ H11

H11

BOSCH

TEST INSTRUCTIONS EP
VDT-WPP 115/1 B

Edition 1.69 replaces 12.65
Translation of German edition of 10.63

Testing INJECTION PUMPS SIZE P

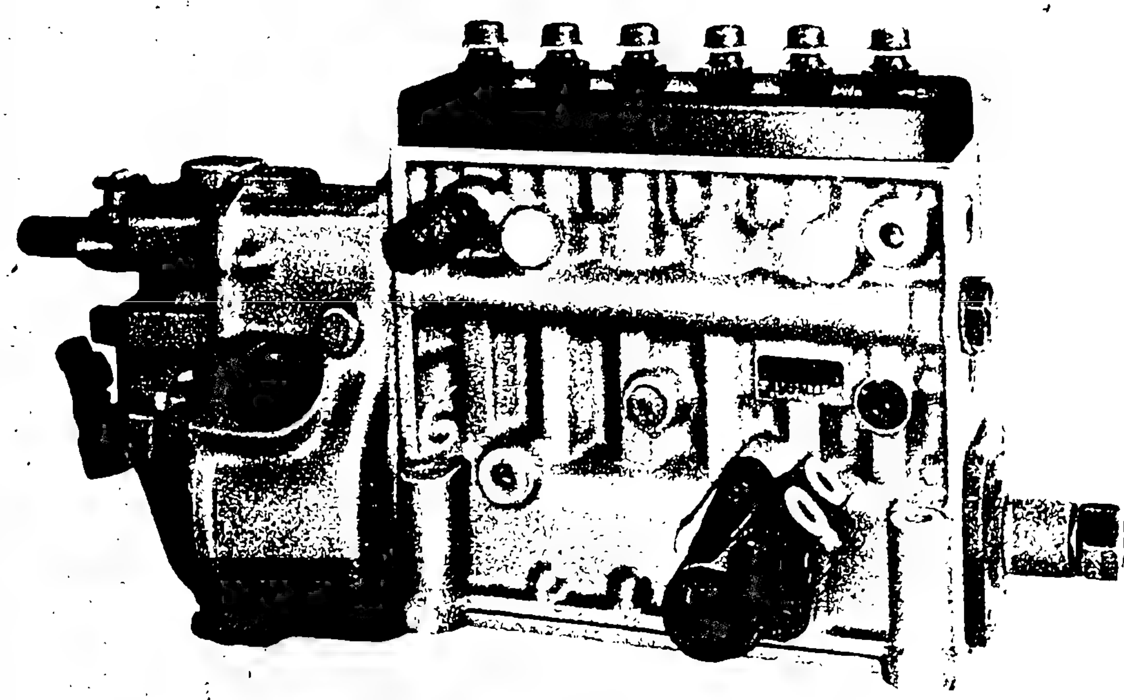


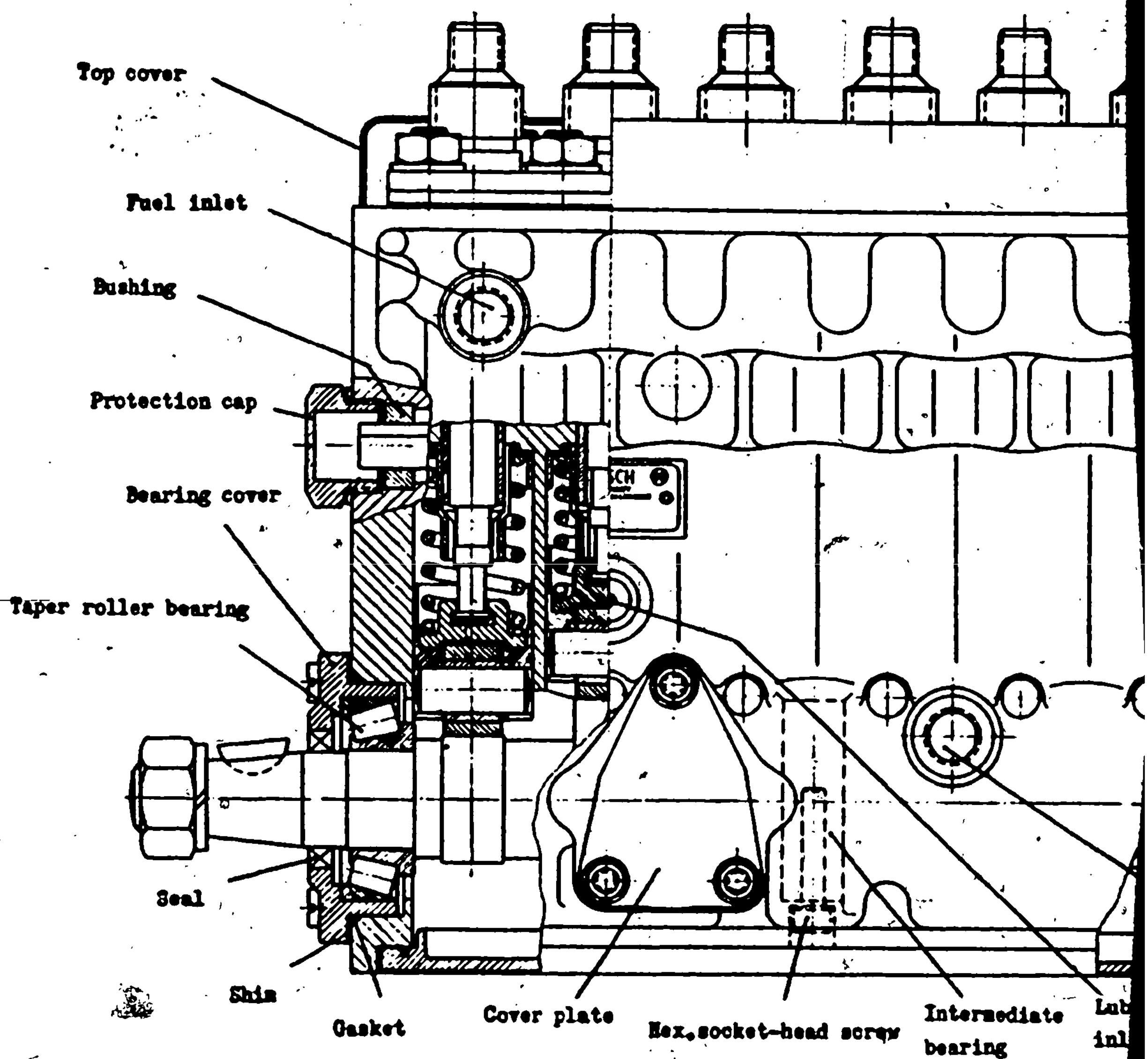
Fig. 1 In-line pump with RQV governor (multi-fuel version)

ROBERT BOSCH GMBH STUTTGART GERMANY

H12

H12 AM

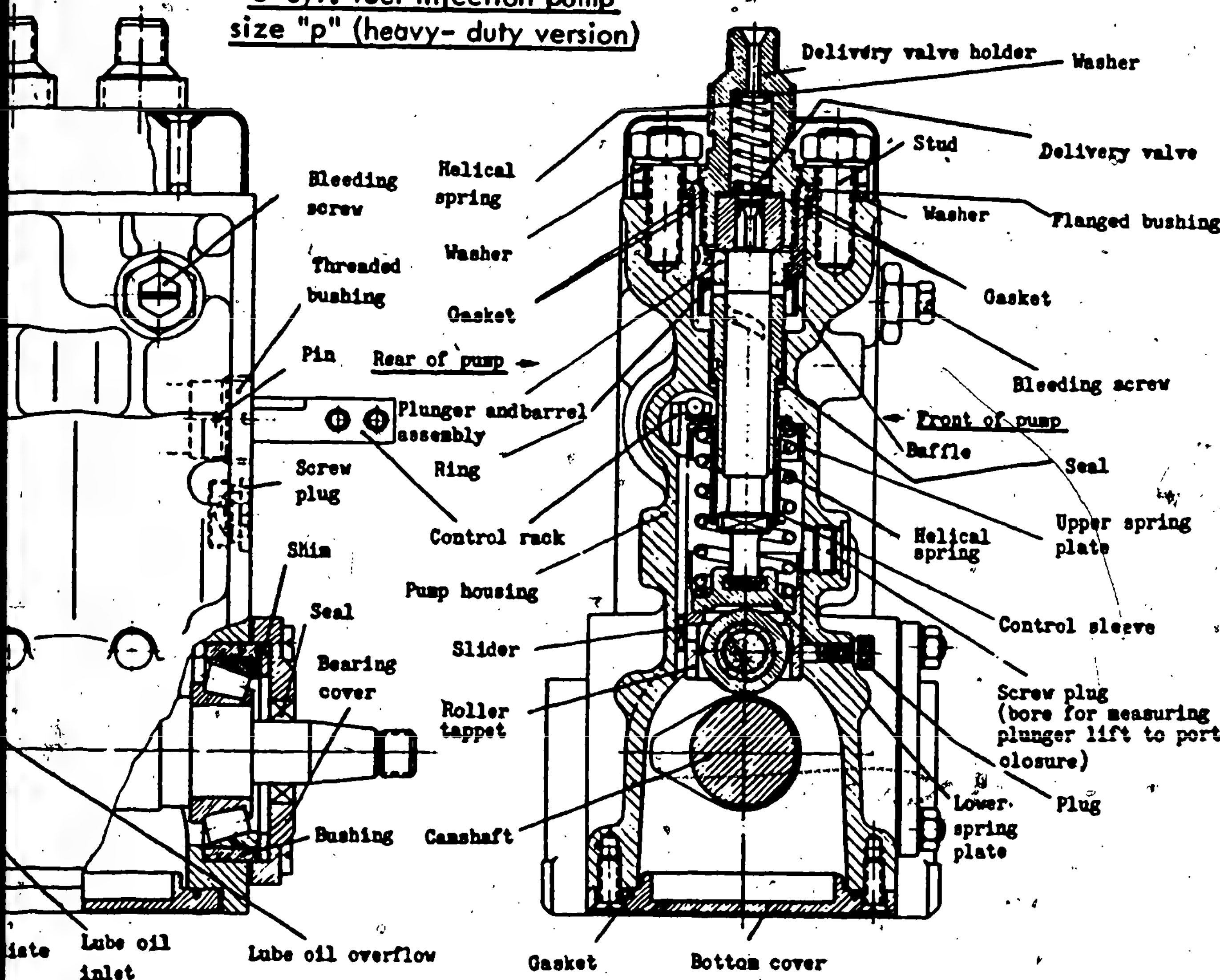
2


Top cover
Fuel inlet
Bushing
Protection cap
Bearing cover
Taper roller bearing
Seal
Shim
Gasket
Cover plate
Hex.socket-head screw
Intermediate bearing

H13

Fig. 2

6-cyl. fuel injection pump size "p" (heavy- duty version)



1114

1. Test equipment		Type No.	Part No.
1.1. Nozzle-holder assembly 1. for plunger and barrel diameters up to 10 mm 2. for plunger and barrel diameters 10.5 mm and up	175+ 5 atm. (2500+ 70 psi)	EF 8511/9 A EFEP 215 A	0 681 343 009 0 681 343 001
1.2. Injection tubing 6 x 1.5x600 for 1.1.1.	Bent	EFEP 35 C	1 680 750 004
for 1.1.2.	Bent	EFEP 198/4	1 680 700 005
for 1.1.1.	Straight	EFEP 198/7	1 680 750 015
for 1.1.2.	Straight	EFEP 198/15	1 680 750 026
1.3. Mounting bracket for flange-mounted pumps of 110 mm (4.33 in) shaft center height (e.g., EFEP 5..&25..)		EFEP 157 A	1 688 010 011
of 125 mm (4.92 in) shaft center height (e.g., EFEP 41 ..)		EFEP 157	1 688 010 010
1.4. Clamping flange for size-P pumps		EFEP 157/7	1 685 720 060
1.5. Support block for flange-mounted pumps of 110 mm (4.33 in) shaft center height (e.g., EFEP 5..&25..)		EFEP 443	1 688 030 030
of 125 mm (4.92 in) shaft center height (e.g., EFEP 41..)		EFEP 444	1 688 030 033
1.6. Mounting block for in-line pumps of 110 mm (4.33 in) shaft center height (e.g., EFEP 5..&25..) (2 required)		EFEP 396 (2 ea)	1 688 120 033
of 125 mm (4.92 in) shaft center height (e.g., EFEP 41..) (2 required)		EFEP 394 (2 ea)	1 688 120 032
1.7. Device for measuring plunger lift to port closure		EFEP 388	1 688 130 021
1.8. Control rack travel measuring device, standard for pumps with supercharge pressure stop		EFEP 393 EFEP 448 and EFEP 449	1 688 130 030 1 688 130 038 1 688 040 010
1.9. Control rack travel dial indicator (for EFEP 393) Measuring range 30 mm, 1/10 graduation		EFAW 144	1 687 233 015
1.10. Coupling (forEFEP 5..&25..) (1)		EFEP 398	1 686 401 001
(for EFEP 41..) (2)		EFEP 399	1 686 401 003
1.11. Coupling guard (for 1)		EFEP 19/24	1 685.510 008
(for 2)		EFEP 87/16	1 685 510 016
1.12. Overflow valve (if not provided on pump)		EPVE 176 P 2 Z	1 417 413 025
1.13. Installing device (for installing 0 ring)		EFEP 387	1 688 110 028
1.14. Extractor (for removing composite barrel unit, when altering commencement of delivery -initially on assembly-)		EFEP 391	1 688 110 026
1.15. Ring wrench, open (21 x 24 serration - initially on assembly -)		EFEP 386	1 687 950 525

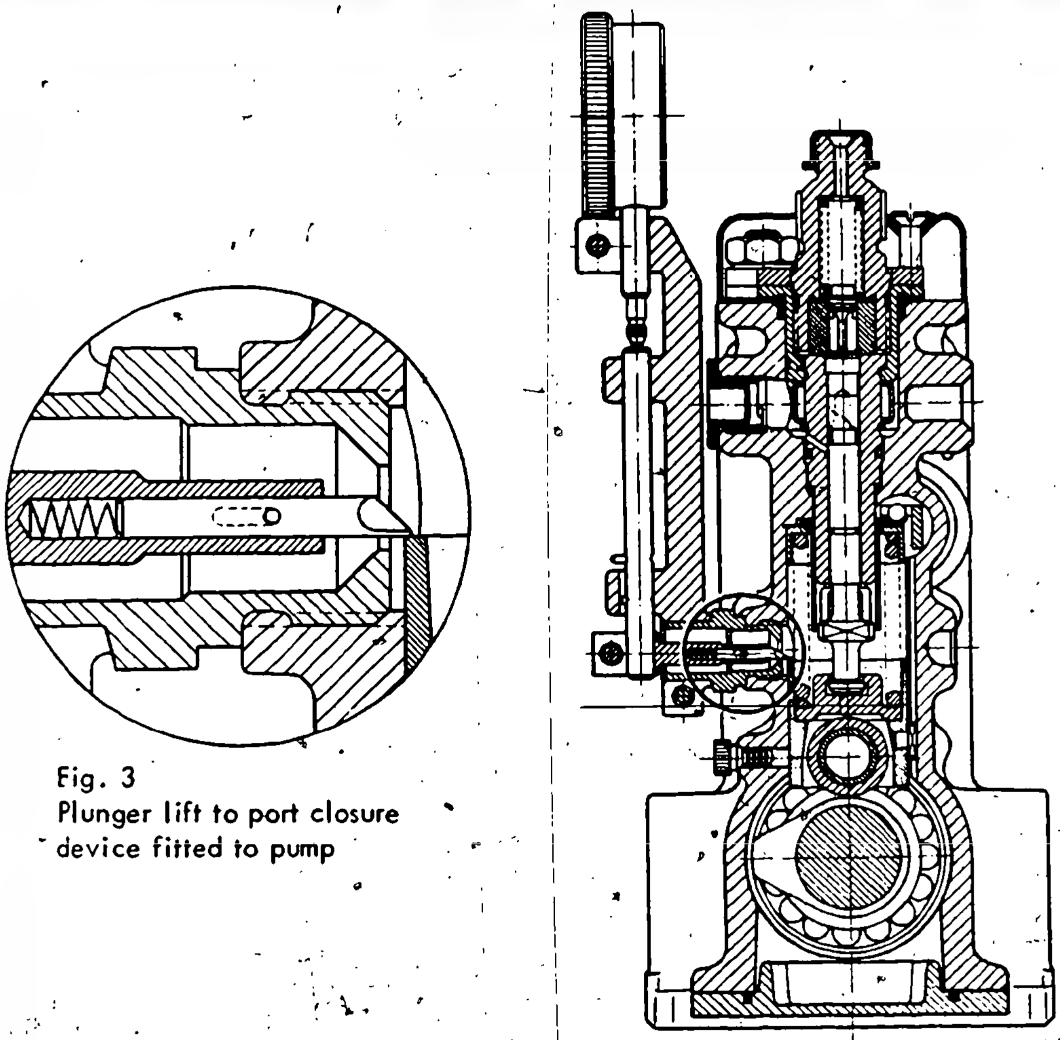


Fig. 3
Plunger lift to port closure device fitted to pump

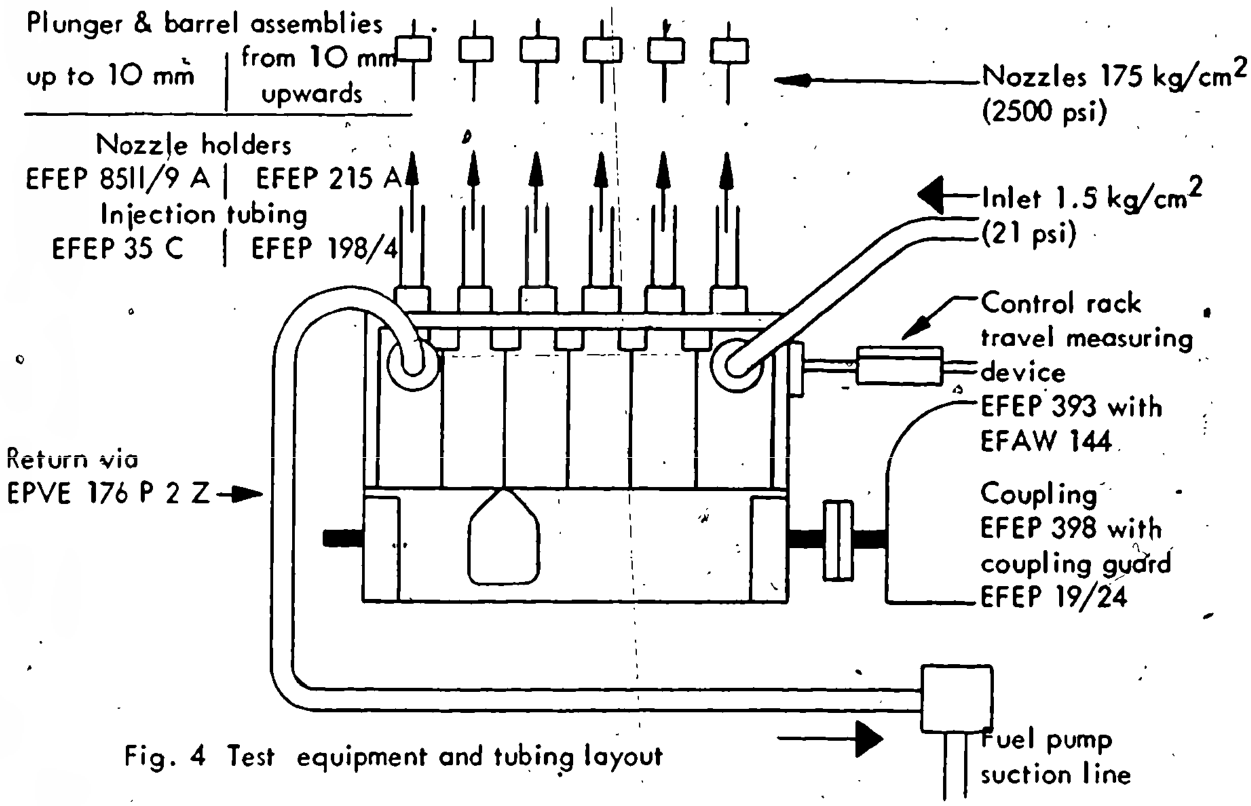


Fig. 4 Test equipment and tubing layout

2. Test conditions

2.1. Introduction

The construction of the pump is described in BEP 115/1 B and repair operations in WJP 115/1 B. Therefore only those details important for testing are repeated here.

To alter the plunger lift to port closure on these pumps, the barrel/valve assembly comprising flanged bushing, barrel, delivery valve, valve spring and delivery valve holder is removed. The desired plunger lift to port closure is obtained by inserting appropriate shims under the flange. Fit the EFEP 388 device for measuring plunger lift to port closure to cylinder number one (drive side) after removing the socket-head cap screw. The feeler then picks up the plunger lift at the upper edge of the roller tappet. A spring-loaded member ensures that the feeler gives way when the camshaft is rotated further (Fig. 3).

The delivery rate (equal delivery) is adjusted by turning the flanged bushing of the barrel/valve assembly (adjustment range about 10°) with the EFEP 386 ring wrench; this also turns the barrel by means of the pin in the flanged bushing. For this adjustment, it is advisable to loosen the delivery valve holders slightly.

2.2. Tubing layout (Fig. 4)

Remove the overflow valve and plug the bore when testing the commencement of delivery. As the test device prevents access to the drive-side connection, the governor-side connection must be used for the inlet in this instance.

2.3. Special notes

In mounting the pump on the test bench and testing, the following points should also be observed.

2.3.1. Coupling:

Two versions of the size P injection pumps are manufactured, a "light" version (S 1 000..) with 20 mm (0.79 in) tapered end of camshaft and 10 mm (0.39 in) claws on the drive coupling and a "heavy" version (S 1...) with 25 mm (0.98 in) tapered end of camshaft and 12 mm (0.47 in) claws on the coupling. An adjustable coupling is therefore necessary, which can be ordered under No. EFEP 398 (1 686 401 001) and easily fitted to EFEP 5... in place of the existing coupling.
The existing coupling can be removed by unscrewing the two hexagon-head screws and the new coupling installed and screwed on. The new enlarged guard should also be fitted at once. Light greasing of the coupling claws to prevent noise is recommended, as with this type of coupling there is steel to steel contact. For the coupling and the injection pump to run faultlessly, the coupling fingers must be aligned horizontally when coupled (compensate for any play) and the hexagonal socket-head screw of the coupling must be tightened carefully.

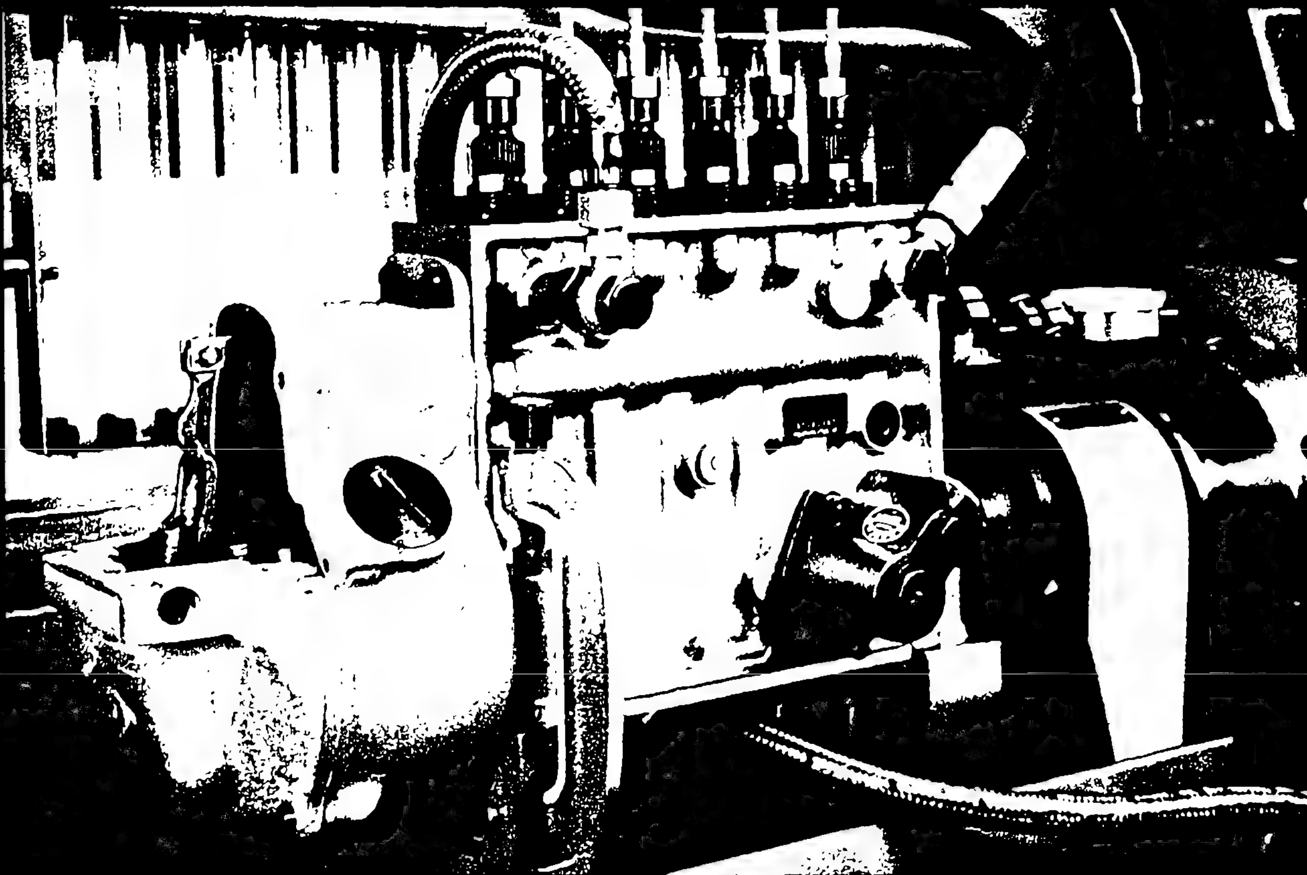


Fig. 5 Pump with sawn-off cover

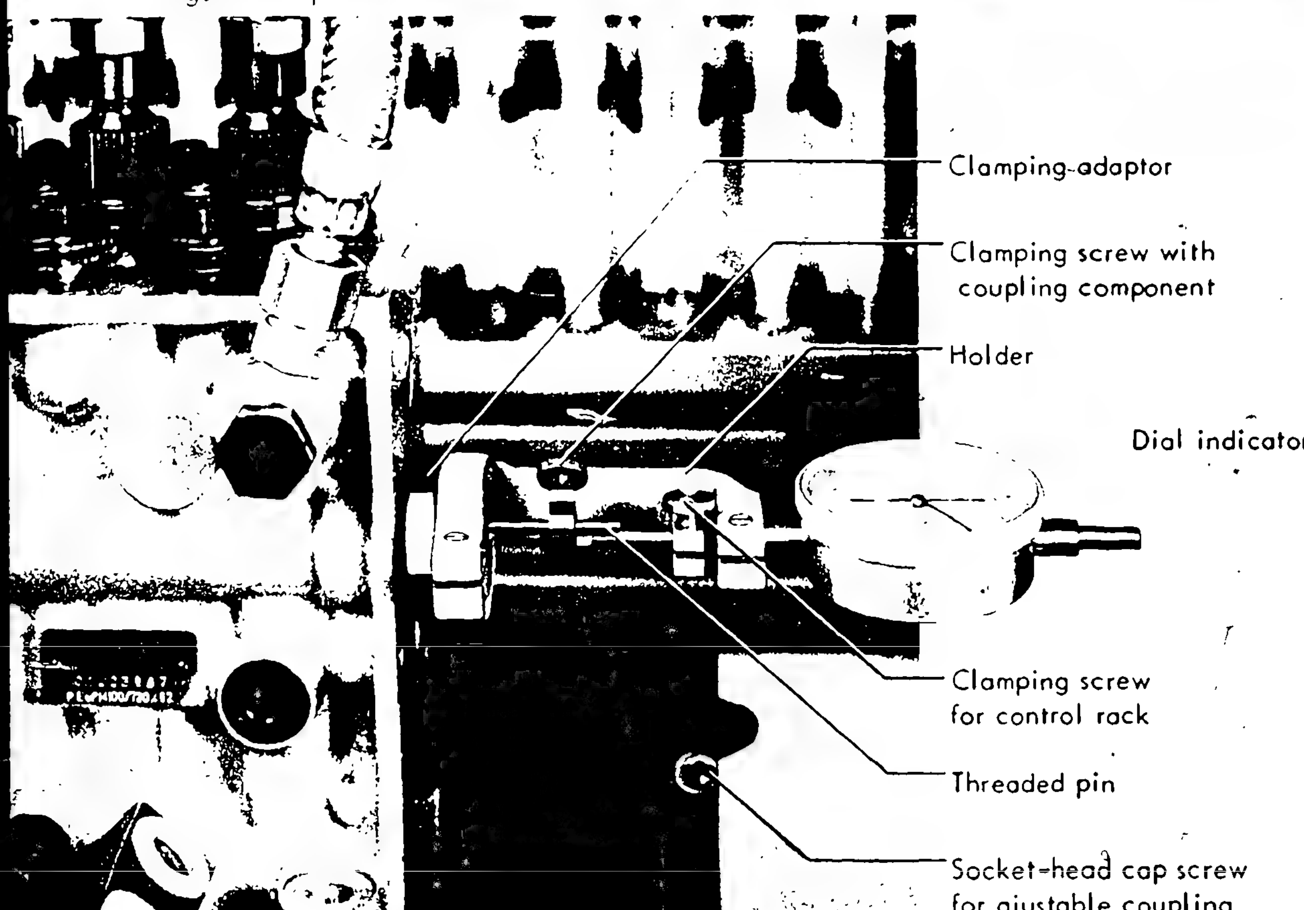


Fig. 6 Control rack travel measuring device with dial indicator

2.3.2. Overflow valves:

The suction-chamber flushing specified for testing P-pumps necessitates the use of an overflow valve. EPVE 176 P 2 Z is stipulated for this purpose which already exists on some of the pumps. The EPVE 219 P 2 Z fitted to the PE 6 PM.. S 2 pump can also be used.
However, overflow valves must be removed and the inlet line connected in their place for testing the commencement of delivery, as the inlet must be disconnected from the drive side due to lack of space. For the PE 6 PM..S 2 pump, the EF 8456/16 reducing adaptor is required for this purpose.

2.3.3. Mounting:
When flange-mounted pumps are fixed to bracket EFEP 157 A or 157 with clamping flange EFEP 157/7, the support bracket EFEP 443 or 444 supplied is to be placed underneath and bolted to the extra fixing holes at the governor end to prevent undesirable vibrations caused by the length and the weight of the 6-cylinder pumps.
For base-mounted pumps, clamping supports with one-sided "C" clamps have been produced which clamp the pump on alternate sides; see that the bore for measuring plunger lift to port closure remains accessible, i.e., that the front "C" clamp is on the opposite side of the pump.

2.3.4. Lubrication:
P-size injection pumps in their "heavy version" (S 1 ...) have a plain bearing as intermediate bearing. Attention must therefore be paid in lubricating, as is the case with the light versions on account of the lubrication of the tappet rollers. For the basic setting of the pump, the fitting of a provisional governor cover sawn off as shown in Fig. 5 for these purposes is recommended. In the case of a flange-mounted pump, the bores in the flange-side bearing cover should also be properly sealed.

2.3.5. Control rack travel measuring device:
To obtain the basic setting for the injection pump and to test the centrifugal governor, the EFEP 393 control rack travel measuring device used in conjunction with the EFAW 144 dial indicator (measuring range 30 mm, 1/10 graduation) was devised. The following sequence of steps is recommended in fitting it.

1. Remove protection cap
2. Screw threaded pin (M 2.3) into the control rack
3. Screw in the clamping adaptor
4. Fit holder
5. Insert the dial indicator and screw coupling component on to dial indicator spindle
6. With the control rack in the STOP position, set the dial indicator to zero and clamp on the coupling component tight. Ensure that the control rack can travel the full distance (approx. 21 mm) (Fig. 6).

For the different method of fitting in the case of pumps with a full-load stop governed by supercharge pressure, see Page 14.

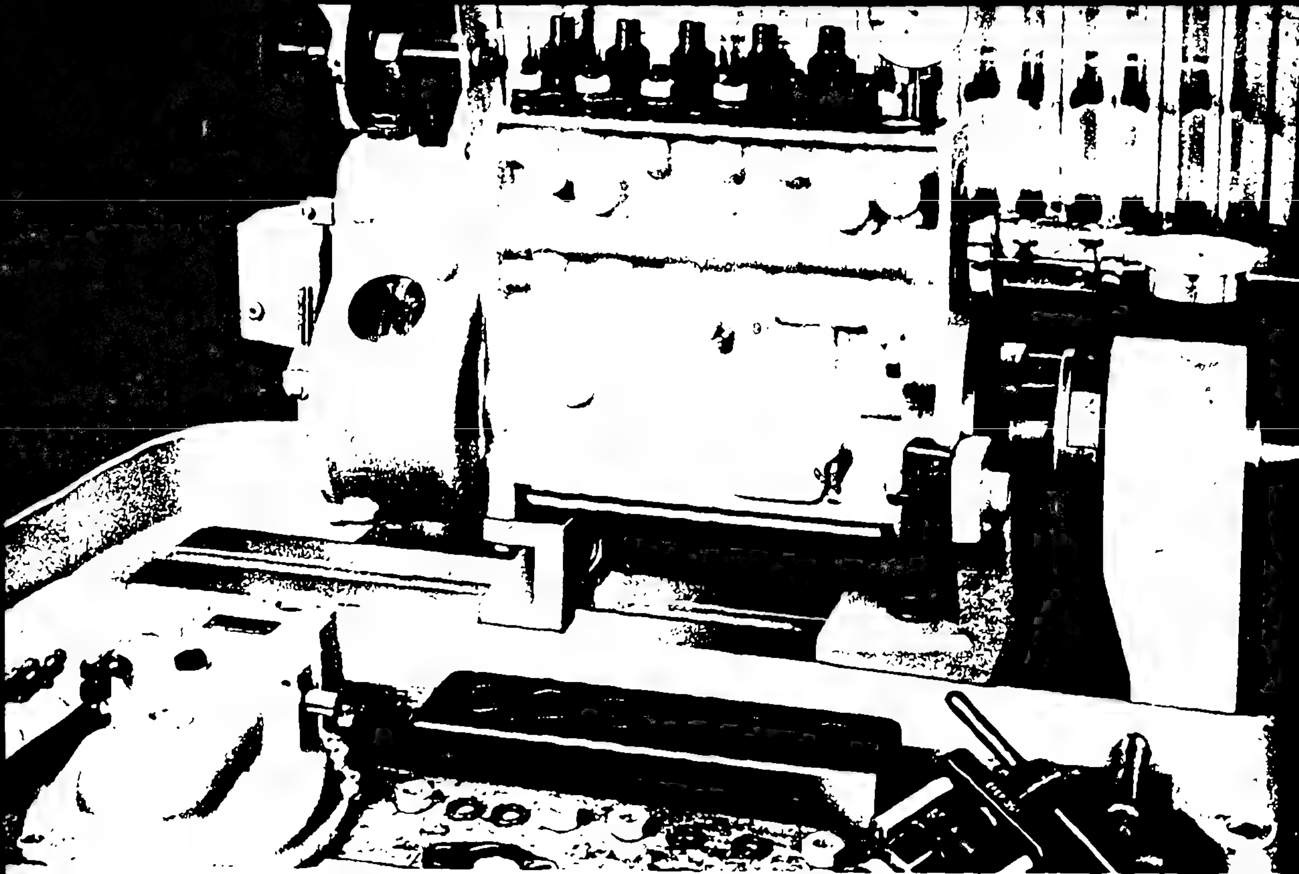


Fig. 7 Removal of the barrel / valve assembly

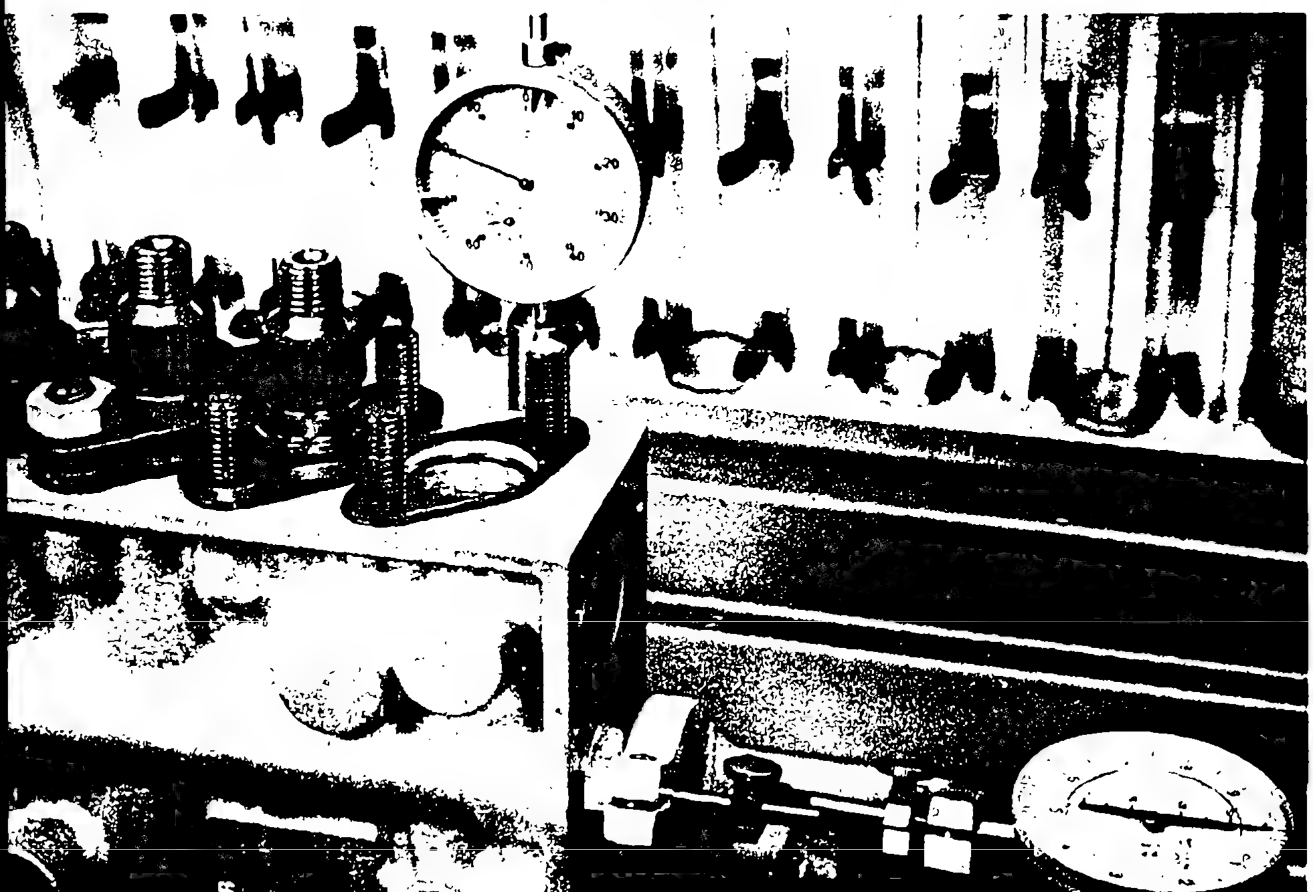


Fig. 8 Exchanging the EPPT 47 P 7 ... 13 X shims

3. Pump testing

3.1. Setting the commencement of delivery (Figs. 7 and 8)

The "plunger lift to port closure, ... mm from B.D.C." is the lift of the plunger from bottom dead center until delivery commences, i.e., until the rising plunger just covers the inlet port and test oil ceases to flow at the overflow pipe.

Mount the pump, remove top cover, set test-bench selector lever to position for testing commencement of delivery and connect up the tubings. Disconnect the governor of pumps with governor, i.e., remove the governor cover. Fit the EFEP 393 control rack travel measuring device with dial indicator 144 and adjust to zero with the control rack in the STOP position. Then adjust control rack to travel specified in Test Specifications for equal delivery test, unless a special rack setting is specified for the plunger lift to port closure measurement. With cylinder 1 (drive side) in the B.D. C. position -roller tappet is visible after removing the hexagonal socket-head screw - screw in device EFEP 388 without gasket, lift the measuring spindle and set dial indicator to zero with cam in the B.D.C. position.

3.1.1. Setting plunger lift to port closure:

Rotate camshaft (in direction of rotation shown on type plate) until the dial indicator shows the measurement specified for plunger lift to port closure. Set the graduated-disc pointer to a convenient number for measurement.

3.1.2. Checking commencement of delivery:

Unscrew bleed screw on the nozzle holder, set test-bench selector lever to position for testing commencement of delivery (if necessary, increase pressure at the adjustable relief valve) and again rotate camshaft from B.D.C. until delivery commences: the graduated-disc pointer must indicate the same reading as before.

3.1.3. Checking the cam phasing:

The commencement of delivery for the other plunger and barrel assemblies is similarly set relative to the barrel tested according to the cam phasing intervals.

for 4-cylinder units 90° intervals
for 6-cylinder units 60° intervals Tol. ± 0.5°
etc.

Abnormal phasing intervals are given on the Test Specifications.

If the checks do not produce the figures stipulated, the EPPT 47 P 7..13 X shims under the flanged bushings must be exchanged. If delivery commences too early, add further shims; if it is too late, remove shims (Figs. 7 and 8).

Use EFEP 391 to extract the barrel/valve assembly and EFEP 387 to install the O rings when replacing. Special attention should be paid to the O rings when re-assembling. It is recommended to set the slots of the flanges in the center during assembly (for delivery rate adjustment).

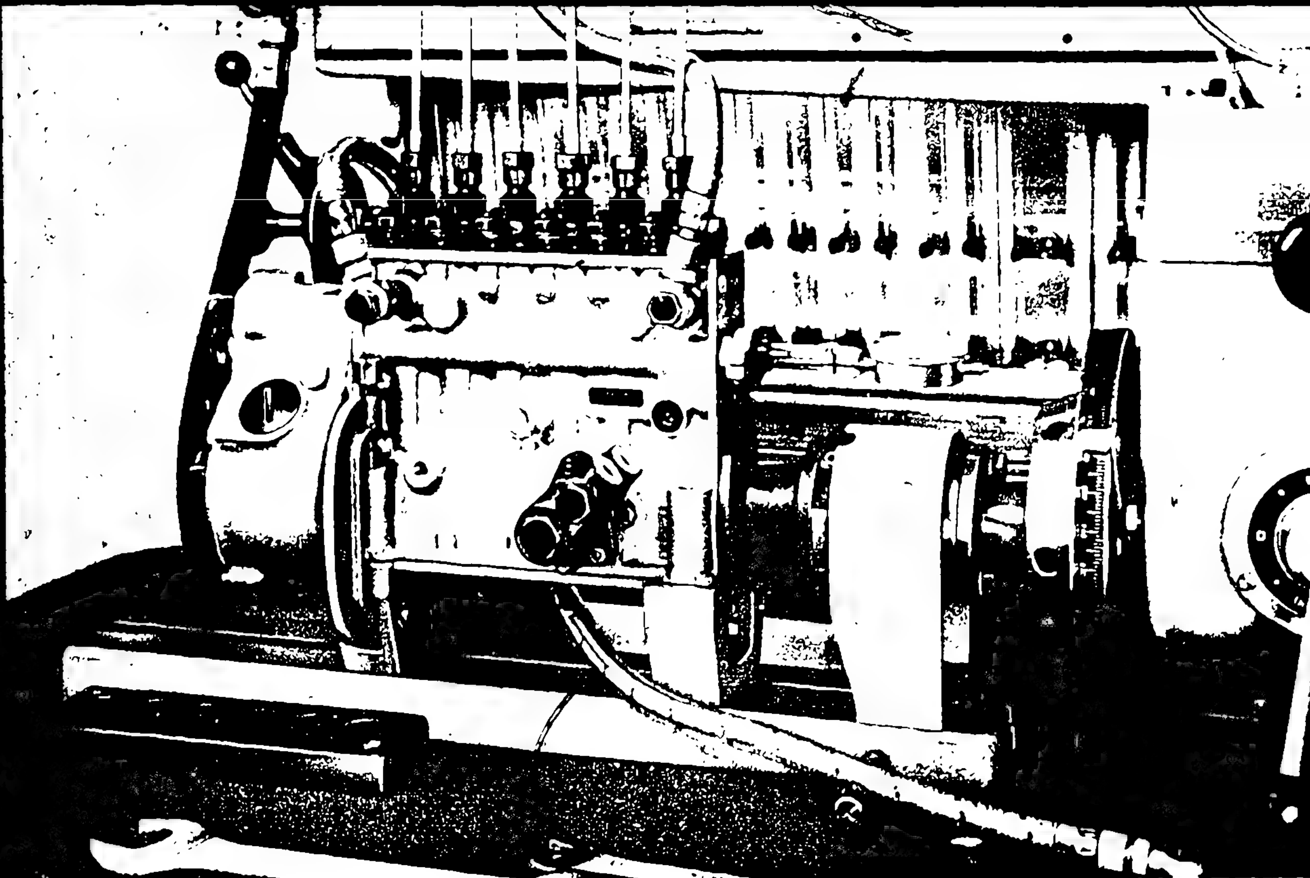


Fig. 9 In-line pump set up for delivery-rate adjustment

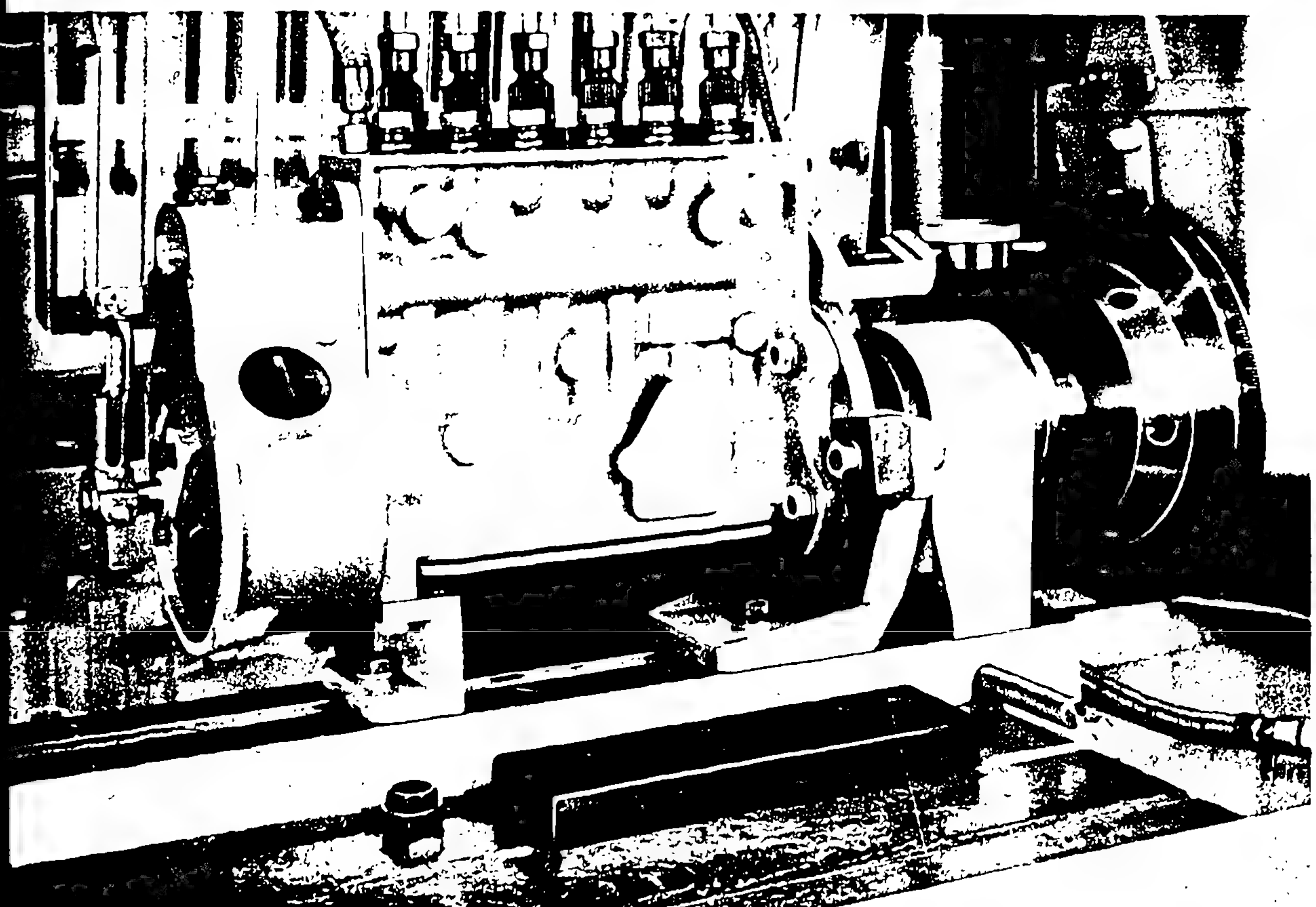


Fig. 10 Flange-mounted pump with support bracket

1641 EH/1

3.2. Setting delivery rate

(Section A of Test Specifications and tubing layout Figs. 9 and 10): Change over lines (inlet on pump side 1 and return line with overflow valve on pump side 2 turned upwards). Set test-bench selector lever to position for testing delivery rate and run pump briefly until it operates smoothly again; the governor remains out of action.

Prior to setting the delivery rate, check the STOP position of the control rack. Then set delivery of the individual plunger and barrel assemblies as laid down in section A of the Test Specifications.

Equal delivery is measured first; it is the basic setting for the delivery rate of all plunger and barrel assemblies. The requisite figures are framed on the Test Specifications sheet.

A final correction of the setting - in particular, the spread in delivery - can be carried out when setting the full-load quantity (separate measurement) as laid down in Section C of the Test Specifications (see also 5.1.). To adjust for equal delivery, the flanged bushings should be turned within the limits of the slots using ring wrench EFEP 386.

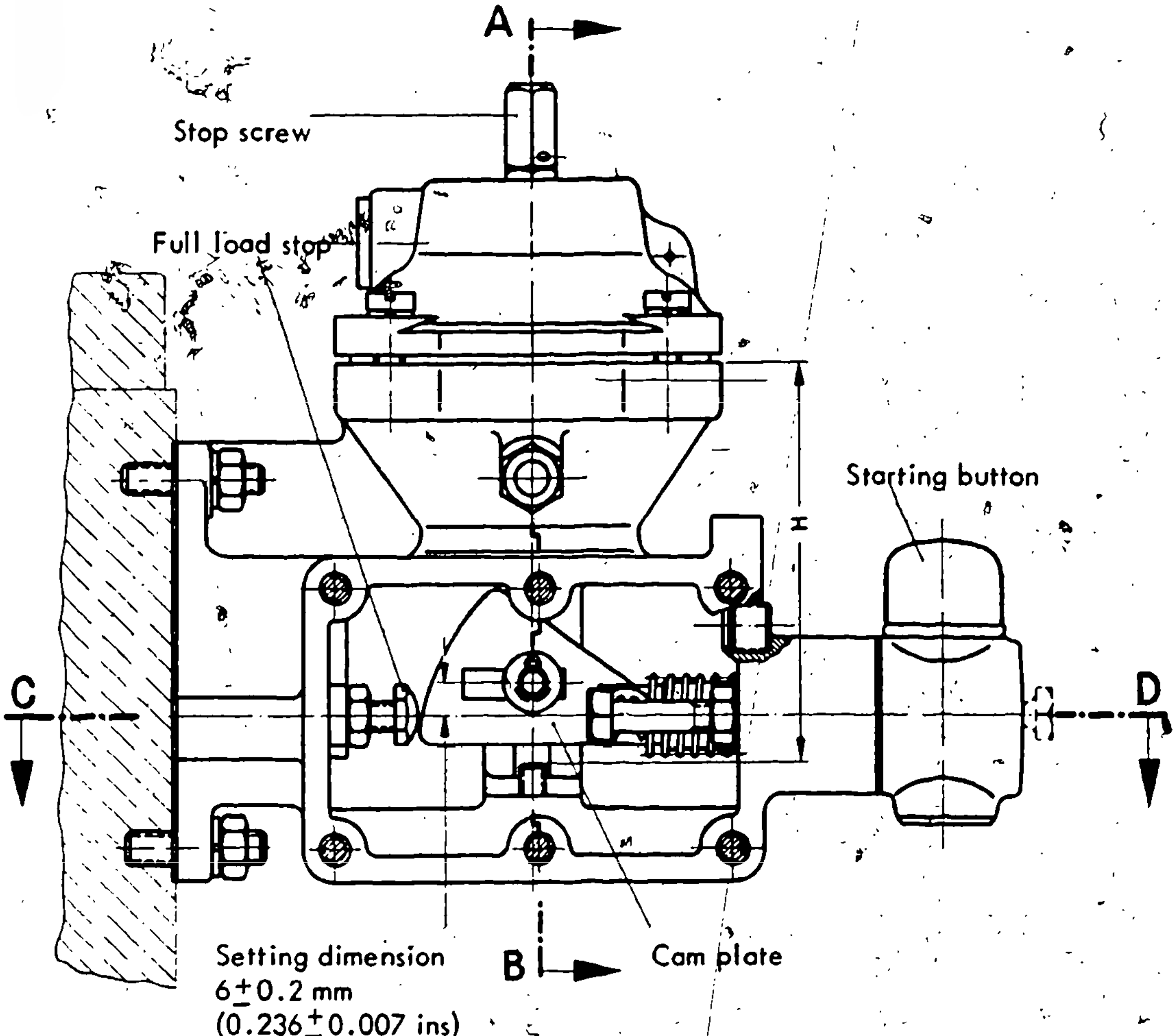
Spread in delivery: The delivery rate of all plunger and barrel assemblies should be equal for this measuring point. It should also be seen that the spread remains as small as possible for the other measurements, as this is the way to assess whether the plunger and barrel assemblies and valves are fit for service. The figure given in Column 4 should be referred to primarily when pumps are checked in service and those with worn plunger and barrel assemblies are tested.

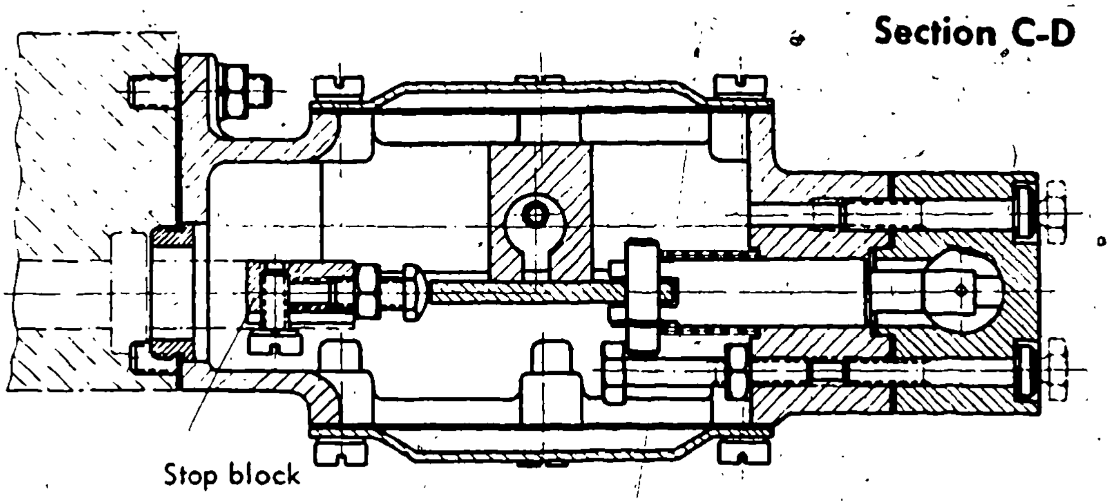
4.-Governor adjustment as in WPP 001/4 B

5. Full load adjustment

5.1. The full-load delivery rate is set as specified in Section C of the Test Specifications at the control-rack stop (for RQV) or at the full-load stop screw (for RQ and RSV).

A delivered quantity within the specified tolerance should be obtained for each plunger and barrel assembly. If there is a discrepancy, the appropriate plunger and barrel assembly should be adjusted. The maximum permissible discrepancy in particular for pumps which are checked in service and those with worn plunger and barrel assemblies, is given in Section A, Column 4.





5.2. Full-load stop governed by supercharge pressure with starting quantity

(Example RQV 200 - 1150 P 7/2 - for Volvo - see sectional view). The data refer to this particular stop. Stops with newer design features with deviating constructional characteristics should be dealt with similarly.

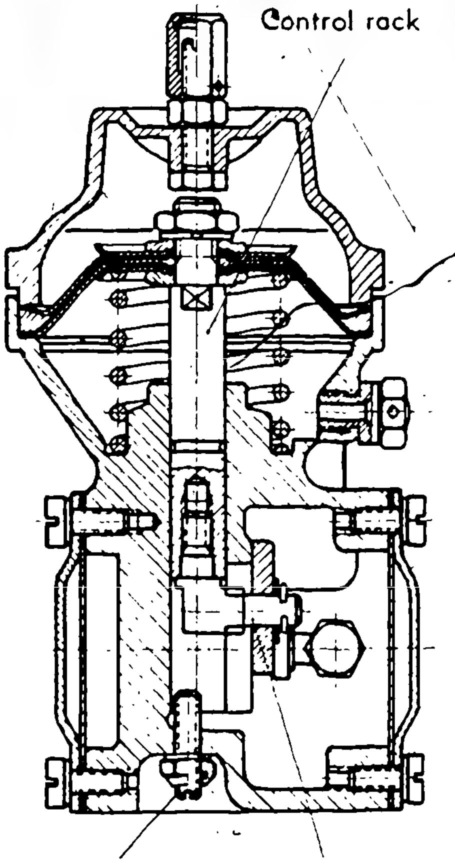


Fig. 11 Full-load stop governed by supercharge pressure with starting quantity

Section A-B

5.2.1. Pre-setting on assembling:

Prior to fitting the control rack with diaphragm, screw in the stud at the bottom of the housing up to "setting dimension H" (measure with depth gage during assembly or height gage when assembled).

When assembly is completed, adjust stop screw in diaphragm cover until setting dimension 6 ± 0.2 mm. (0.236 ± 0.007 in) is obtained (center of full-load stop to center of angular bolt).

Move full-load/starting stop to the full-load position.
Press starting button, slide cam plate in the direction of start and release.
The limit of travel now reached in the direction of "Full load" is the full-load position. Then adjust limiting screw so that the stop bolt between screw head and starting button has as little play as possible without jamming the starting button (clearance 0.25 + 0.1 mm, ≈ 0.01 + 0.003 in).

5.2.2. Full-load adjustment on test bench:

Basic adjustment of the governor and full-load setting with supercharge pressure as laid down in Sections B and C of the Test Specifications.
The supercharge pressure, i.e. over-pressure, specified for testing can be obtained with compressed air, a commercially available pressure-reducing valve and a 0-3 kg/cm^2 (0-42 psi) pressure gage.
It is expedient to fit the pre-adjusted stop to the pump only after basic adjustment of the governor. First fix the stop block to the control rack, then place the gasket in position and screw on the unit.

Control rack travel measuring device on pumps with supercharge-pressure stop

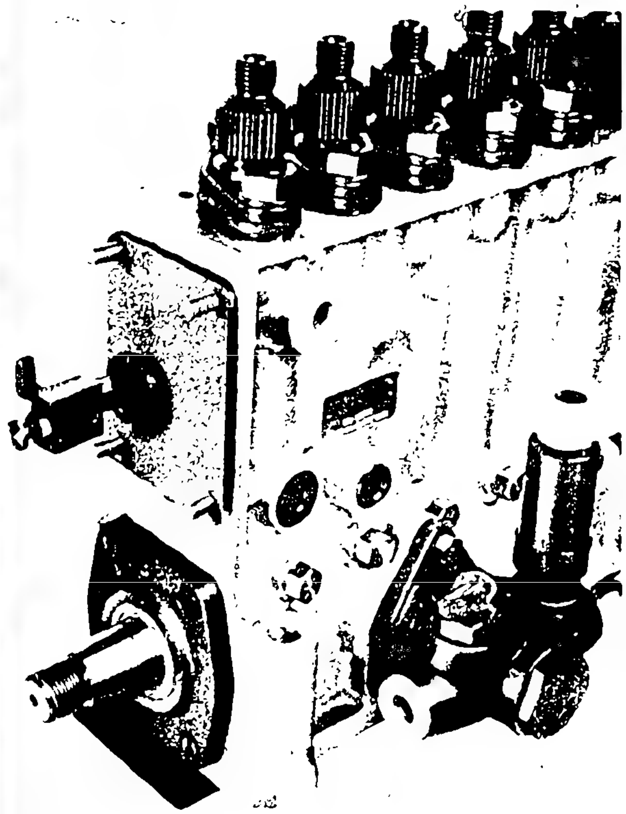


Fig. 12 Remove full-load stop governed by supercharge pressure and ...

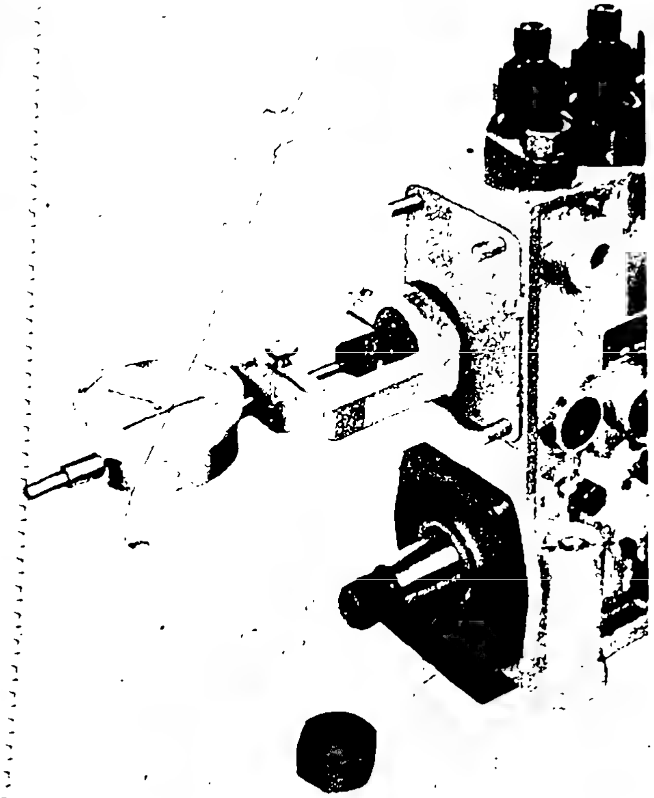
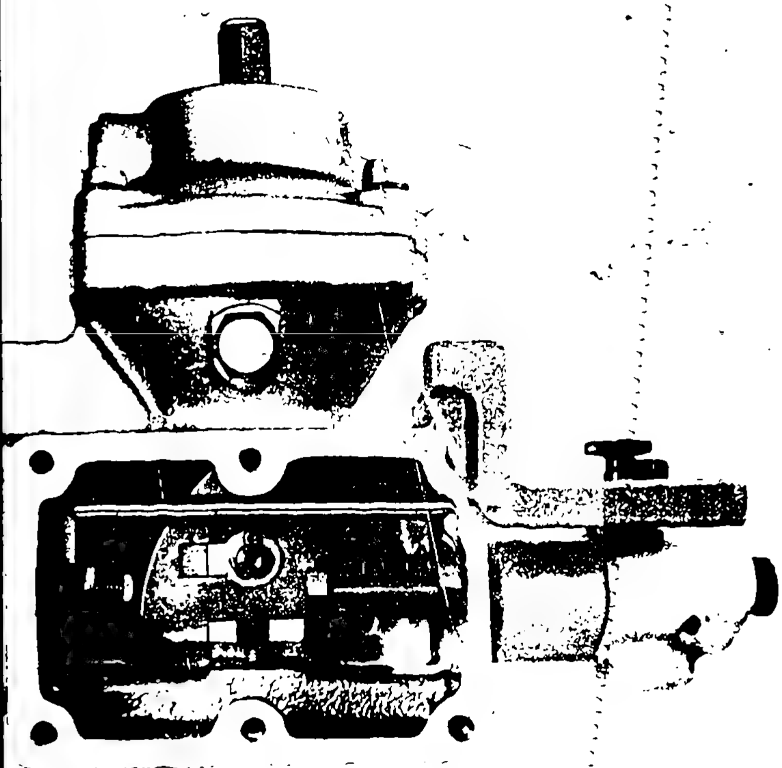
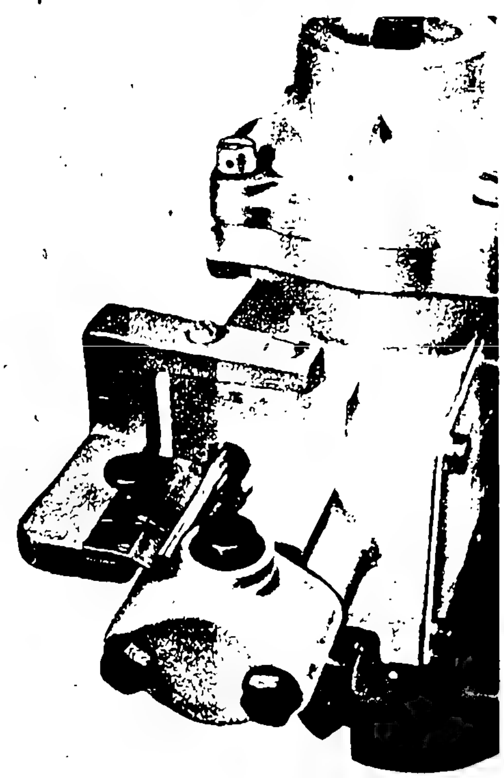


Fig. 13 ... fit EFEP 393 control-rack travel measuring device with coupling component EFEP 449





Figs. 14 and 15 Measuring control-rack travel with EFEP 448 with full-load stop fitted

If the full-load stop is already fitted, the stop screw must be screwed back for governor adjustment so that a control-rack travel of at least 16 mm is obtained.

Run pump at specified speed, move control lever to "Full load", set supercharge pressure (over-pressure) and limit delivery rate with the full-load stop.
The measurement without supercharge pressure (zero over-pressure) must then yield the delivery rate specified; if this does not occur, the delivery rate can be adjusted slightly with the stop screw in the cover of the diaphragm housing.

5.2.3. Testing the starting position:
Do not run pump, control lever at "Full load", over-pressure 0 kg/cm^2, read off control rack position at full load. Press starting button, control rack must travel 9 mm further in "full-load" direction. When the control lever is brought back to stop, the starting button must snap back briskly. On shifting the control lever to the full-load position again, the full-load control rack position read off must be obtained once more.

6. Final operations

6.1. Leakage test
Apply pressure on leak-oil blockage with OI 61 v 11. Pressure must drop from 15 kg/cm^2 (215 psi) to 10 kg/cm^2 (145 psi) in at least 10 sec. (only for PE..PM pumps).
Pressure-test suction chamber in oil bath with compressed air at 2.5 kg/cm^2 (35 psi) making connection at inlet bore.
Pressure-test pump and governor in oil bath with compressed air at 0.3 kg/cm^2 (4.3 psi), making connection at oil-level checking bore in camshaft chamber.

6.2. Secure and lead-seal stops, see WPP 001/4 B.

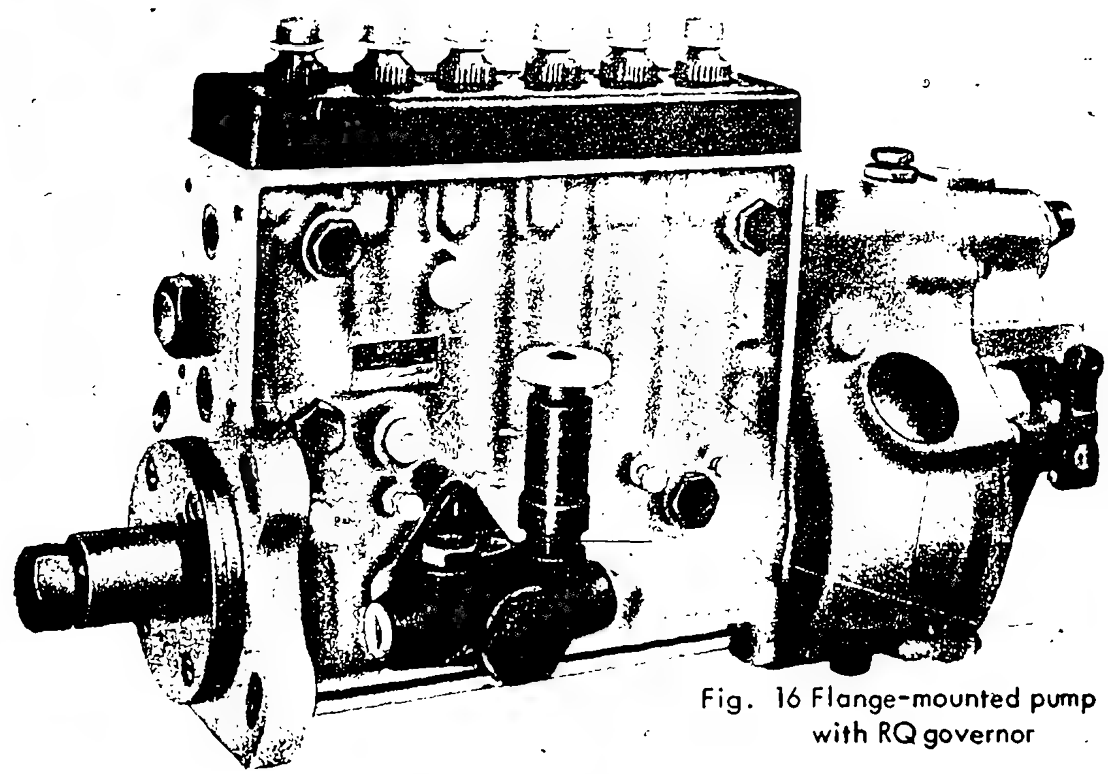


Fig. 16 Flange-mounted pump with RQ governor

Kenntnis genommen: Noted by:	Bearbeiter Project Specialist	Inhaber Owner	Meister Supervisor	Mechaniker Mechanic

Porsche "911 E (C) and 911 S (C)"
Injection system

VDT-BMP 701/8 B — EP
Edition 5.70

Translation of German edition of 17.9.1968

To VH, AV/S, BD, BV

General remarks

The fuel injection engines of the new Porsche models "911 E (C) and 911 S (C)" are equipped with the BOSCH injection pump PED 6 KL.. with mechanical mixture control governor EP/RLA.. .

Pump and governor differ only slightly from the familiar version PES..KL.. with EP/RLA.. (see "Information on New Products" VDT-BEP 701/2 dated 18.7.68).

The above mentioned BEP stated that for the time being only an exchange of the complete unit had been provided for in the case of complaints about the injection pump in these new vehicles.

This Technical Information Sheet gives pointers regarding the construction and function of the complete injection system with auxiliary devices, on testing facilities and on the removal and installation of individual parts.

Contents:

1. Construction and function

1.1 Fuel circuit

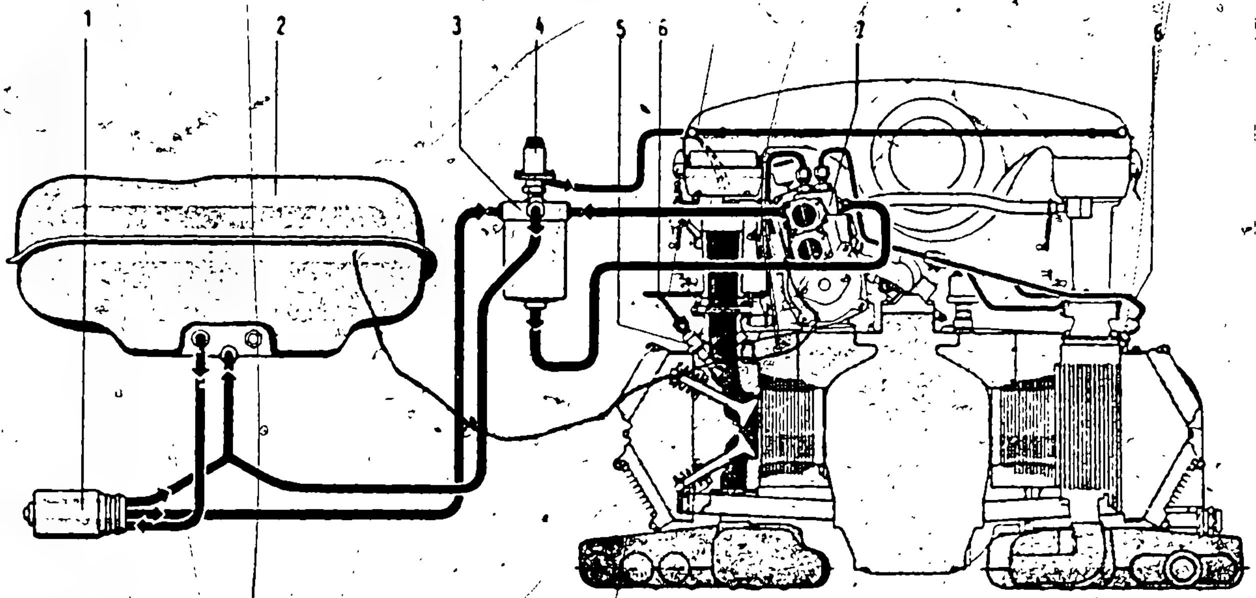


Fig. 1 - Fuel circuit diagram

1 Fuel pump
2 Fuel tank
3 Fuel filter
4 Electro-magnetic valve for auxiliary cold-start device
5 Injection valve
6 Delivery line
7 Injection pump

The fuel pump is situated beneath the fuel tank and is accessible from under the vehicle after removing a cover plate. It is a roller-type rotary pump, flanged directly onto the driving electric motor. The delivery quantity is approx. 110 l/h (approx. 29 US gal/h, 24 Imp gal/h). This excess quantity prevents heating and the formation of fuel vapor locks in the fuel circuit and in the injection pump gallery.

The fuel pump draws fuel from the tank and forces it through a fine filter into the injection pump gallery. The excess quantity from the injection pump gallery flows to the filter and from there back to the tank via an overflow valve.

The overflow valve is permanently set to a pressure of 0.8 ± 0.2 kgf/cm^2 (11.4 ± 2.84 psi). Therefore the fuel in the entire system as far as the return line is under this permanently set pressure.

If the pressure in the pressure line from the fuel pump to the filter exceeds the value stated (e.g. as a result of a clogged filter) the fuel is passed back into the tank via the pressure relief valve (by-pass valve) incorporated in the fuel pump. The by-pass valve and attached return line also serve to vent the system.

3NP 40118

The return lines from the over-flow valve in the filter and from the by-pass valve in the fuel pump are joined by a T-piece next to the fuel pump.

1.2 Compensation devices

Since the construction and function of the pump and governor with 3-D cam, flyweight assembly and compensator unit of the version PES..KL../ with EP/RLA.. are sufficiently familiar, they need not be dealt with in detail here.

The altitude capsule on the compensator unit is also identical to that of the familiar version.

The automatic warm-up enrichment, on the Porsche version, is achieved by means of a warm-air thermostat through which the cooling-air for the engine passes. In contrast to the cooling-water thermostat for water-cooled engines, the warm-air thermostat is not situated on the compensator unit but on the governor cover and acts on the guide pin of the compensator unit via a pivoted, bushed angle plate.

In addition, the start solenoid and a shut-off solenoid are situated on the governor cover.

1.2.1 Warm-up thermostat

The warm-up thermostat consists of a number of thermal expansion elements over which the cooling air flows. When the engine is cold, the thrust bolt on which the thermal expansion elements are located has a certain travel.

This travel, transmitted via the compensator unit, results in a definite control rod position corresponding to a super-enrichment of the fuel/air mixture.

As the engine warms up, the thermal expansion elements produce an increasing guide pin travel. Thus the control rod is drawn in the shutoff direction and the fuel enrichment is reduced.

At a temperature of approx. 35° C (95° F) the warm-up thermostat no longer affects the control rod position.

1.2.2 The start solenoid

When starting the engine an excess quantity of fuel (starting quantity) is required. The necessary control rod position is brought about by the travel of the start solenoid. The start solenoid acts directly on the control rod via a lever.

The current is supplied to the solenoid via a relay which is controlled by a time switch and a thermo-time switch (see electrical circuit diagram, page 16).

At each starting operation the time switch closes the current circuit for 2 seconds regardless of the air or engine temperature.

At temperatures between + 2° and - 25° C (+ 35° and - 13° F) the thermo-time switch keeps the current circuit to the start solenoid closed for a correspondingly longer period.

For temperatures between - 10° and - 30° C (+ 14° and - 22° F) an auxiliary cold-start device is operated via a second thermo-time switch (see para. 1.2.3).

Both thermo-time switches are screwed into a cover on the crank case.

.J2

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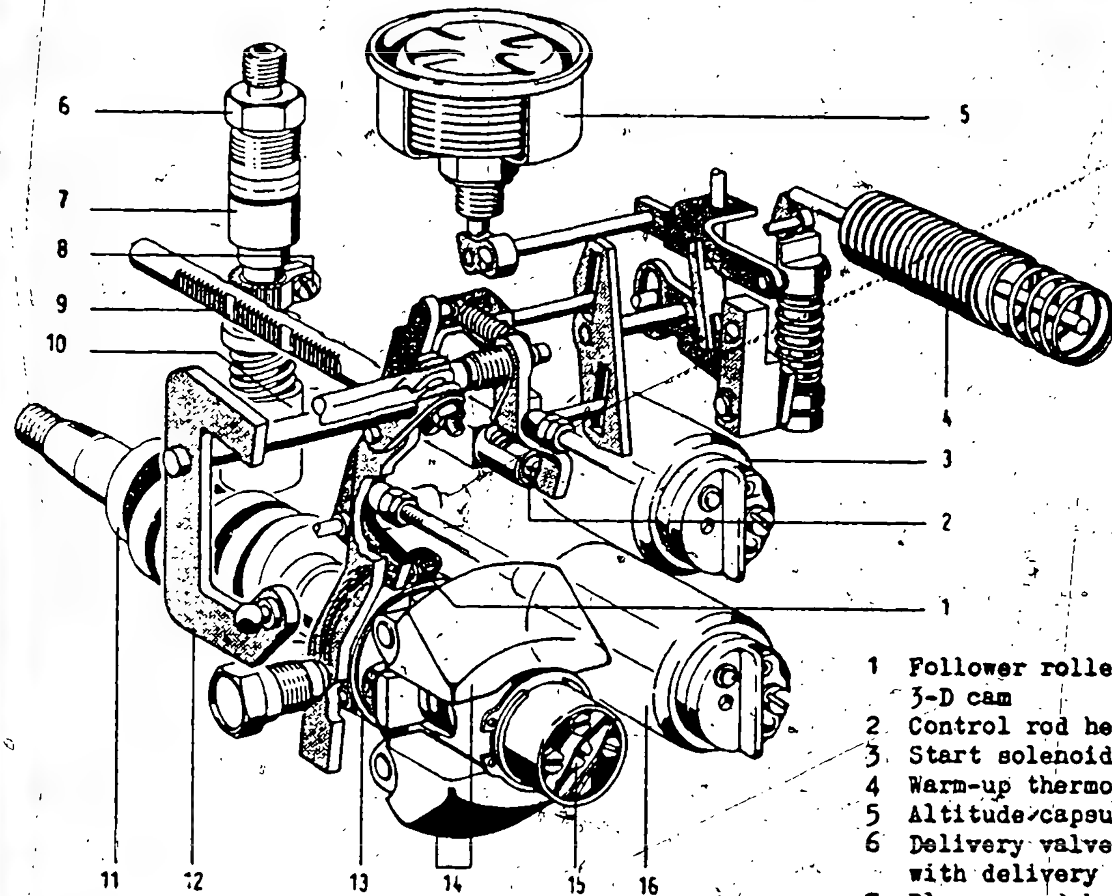

Fig. 2 - Governor diagram

1 Follower roller on the 3-D cam
2 Control rod head
3 Start solenoid
4 Warm-up thermostat
5 Altitude capsule
6 Delivery valve holder with delivery valve
7 Plunger and barrel assembly
8 Control sleeve with gear segment
9 Control rod
10 Roller tappet
11 Camshaft
12 Governor control lever
13 3-D cam
14 Flyweights
15 Idling adjustment screw
16 Shut-off solenoid

1.2.3 Auxiliary cold-start device

An auxiliary cold-start device is available for cold-starting at temperatures between - 10° and - 30° C (+ 14° and - 22° F). It consists of two fine tubes in the air cleaner which are arranged above the induction pipes. The tubes have a fine hole above each induction pipe. The two tubes are connected to an electro-magnetic valve by a hose. This electro-magnetic valve is situated on the fuel filter and is directly subject to the internal fuel pressure of 0.8 ± 0.2 kgf/cm^2 (11.4 ± 2.84 psi).

During the starting operation a second thermo-time switch closes the current circuit to the electro-magnetic valve by means of a relay. While the valve is open fuel flows to the two tubes in the air filter and is injected through the fine holes directly into the induction pipes.

J3

33 J2 x4

1.2.4 The shut-off solenoid

The shut-off solenoid is responsible for bringing the control rod into the stop position, i.e. no delivery while the engine is coasting in gear.

The shut-off solenoid is controlled by a microswitch and a rotational speed regulated switch (referred to in this text as RSRS). The microswitch is attached to the first left-hand induction pipe and is operated by the accelerator pedal linkage. The RSRS is controlled by the battery capacitor dicharge ignition control unit and switches in when the engine exceeds 1500 rev/min. If, while driving, the accelerator pedal is released, the contacts of the microswitch close, the current circuit from the RSRS is completed and the shut-off solenoid pulls the control rod towards the stop, i.e. the engine receives no more fuel. Should the engine speed fall below 1300 rev/min the RSRS interrupts the current circuit to the shut-off solenoid which releases the control rod, and hence permits fuel delivery again. The engine therefore can continue to run at idling speed when the vehicle is stopped. Even though the RSRS switches in again at 1500 rev/min when accelerating, the current circuit to the RSRS is interrupted by the microswitch due to the position of the accelerator pedal linkage.

1.2.5 The injection valves

The EP/DCC 45 R 3 injection valves used are ball valves and differ from the familiar version for Mercedes-Benz vehicles, DC 8 C 45 R 2, in that they have a different holder shape and a smaller thread (M 12 x 1.5).

In the case of these valves, the valve group is flanged into the holder, therefore repair work is impossible. Defective injection valves must be replaced (see para. 2.13).

2. Test work on the injection system

Before attempting any test work or other jobs on the injection system, a prerequisite is that tests be made to verify that the engine and ignition are in order.

2.1 Check supply pump pressure

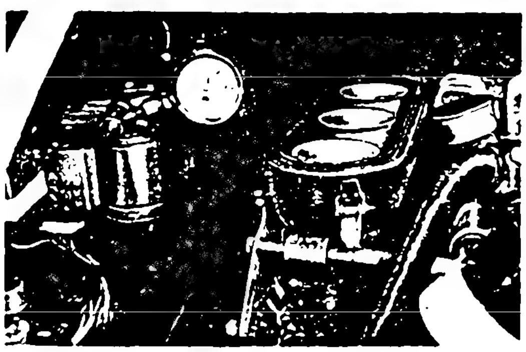

Fig. 3 - Supply pump pressure test

2.1.1 Screw out, at the filter, the hollow screw of the return hose from the injection pump to the filter.

2.1.2 Reconnect the return hose to the filter together with the pressure gauge (Porsche special tool P 233 B) using the long hollow screw supplied with the gauge.

J4

2.1.3 Switch on the ignition and read off the pressure from the pressure gauge. The pressure should be 0.8 $\pm$ 0.2 kgf/cm^2 (11.4 $\pm$ 2.84 psi). If this pressure is not reached, the following may be the cause of the trouble:

a. Clogged filter - replace filter cartridge.

b. Overflow valve in the filter at return connection to tank defective - if necessary, replace overflow valve.

c. Voltage drop in the electrical connecting lead to the fuel pump-eliminate voltage drop.

d. Fuel pump damaged, replace if necessary.

2.2 Check fuel pump delivery quantity:

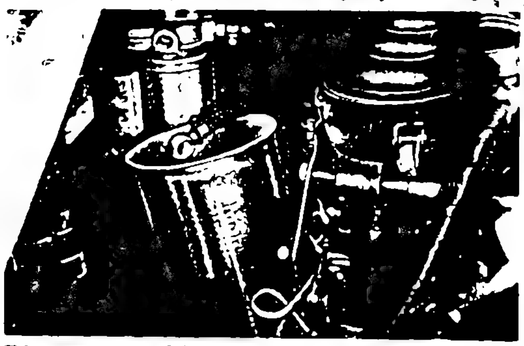

Fig. 4 - Delivery quantity test

2.2.1 Screw out, at the filter, the hollow screw of the return hose from the injection pump to the filter.

2.2.2 Hold the supply line in a measuring glass (min. capacity 1000 cm^3 e.g. EFEP 116 - 1 685 439 505).

2.2.3 Switch on the ignition for 30 seconds. The delivery must amount to 800 - 1000 cm^3. If this quantity is not obtained, consult para. 2.1.3. points a. to d. for possible causes.

The voltage at the connecting terminals of the fuel pump must be at least 11 volts. The current consumption of the fuel pump must lie between 2.0 and 2.3 Amps during the test.

2.3 Check the function of the start solenoid:

2.3.1 Remove the protective rubber cap on the drive side of the injection pump and screw a M 5x30 screw into the control rod.

2.3.2 Pull out the control rod by the screw in driving direction until it reaches the stop and then release. The control rod must slide back to its original position. If the control rod jams, the injection pump should be removed for repair or replaced.

2.3.3 Operate the start solenoid by bridging with a cable to the connector junction box (on the left in the engine compartment) and while doing so observe the control rod at the screwed-in screw. The control rod must move in the driving direction to about 0.5 - 1 mm before the end stop. This control rod position corresponds to the start quantity.

If the control rod is not moved, despite its being able to move freely, the start solenoid must be replaced.

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BHP 7018

2.4 Test time switch:

2.4.1 Connect test lamp to the connecting cable of the start solenoid.

2.4.2 Pull off the 2-pole plug at the battery capacitor discharge ignition control unit.

2.4.3 Operate starter for more than 2 seconds. The test lamp must light up for 2 seconds. If it does not light up for 2 seconds, replace the time switch.

2.5 Test thermo-time switch for start solenoid:

At temperatures between + 2° and - 25° C (+ 35° and - 13° F) the thermo-time switch closes the circuit to the start solenoid for more than 2 seconds. The test is carried out at the start solenoid with the test lamp, as for the time switch test (para. 2.4). However, since, in the workshop, tests cannot normally be carried at these low temperatures, the thermo-time switch should be replaced in case of doubt.

2.6 Test the auxiliary cold-start solenoid (on the filter):

2.6.1 Loosen the hose clamp at the hose connection of the auxiliary cold-start solenoid. Pull off hose.

2.6.2 Switch on ignition.

2.6.3 Operate the auxiliary cold-start solenoid briefly by bridging with a cable to the connector junction box (on the left in the engine compartment). While doing so fuel must escape from the nozzle at the auxiliary cold-start solenoid. Collect escaping fuel. If no fuel escapes, the solenoid must be replaced.

2.7 Test the thermo-time switch of the auxiliary cold-start device:

The auxiliary cold-start device is switched on by the thermo-time switch during the starting operation only at temperatures between - 10° and - 30° C (+ 14° and - 22° F).
Since testing at such low temperatures is not possible in the workshop, the thermo-time switch should be replaced in case of doubt.

2.8 Test rotational speed regulated switch (RSRS):

2.8.1 Connect test lamp to terminal 1 of the rotational speed regulated switch.

2.8.2 Start engine and accelerate slowly, observe revolution counter while doing so. At 1500 rev/min the test lamp should light up.

2.8.3 Throttle down slowly. As the speed falls the test lamp should go out again at 1300 rev/min.
If these values are not obtained, replace the rotational speed regulated switch (RSRS).

2.9 Test microswitch:

2.9.1 Connect test lamp to rear connection (in driving direction) of the microswitch.

2.9.2 Start engine and accelerate. Test lamp must not light up.

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2.9.3 Decelerate to idling speed. Test lamp must light up and go out again at 1300 rev/min.

If these conditions are not fulfilled, check setting of the microswitch (see para. 7.2) or replace it.

2.10 Test shut-off solenoid:

2.10.1 Remove protective rubber cap from drive side of the injection pump and screw an M 5x30 screw into the control rod.

2.10.2 Start engine and accelerate to 3000-4000 rev/min, then decelerate and observe control rod at the screw. The control rod must move opposite to the driving direction (in the direction "stop" of the injection pump). If the control rod does not move, replace the shut-off solenoid if the points mentioned in paras. 2.8 and 2.9 are in order.

2.11 Test warm-up thermostat:

The warm-up thermostat on the governor cannot be tested with normal workshop equipment and can only be replaced in case of doubt.

2.12 Check the arrangement of the control levers:

The control lever on the injection pump governor and the control lever of the throttle valve must maintain a distinct relationship to one another throughout their travel.
During idling the governor control lever and the throttle valve control lever lie against their stops (0°). The throttle valve stops are set during production and sealed with paint. On no account may they be altered. The governor control lever stop is set on the pump test stand and may also not be altered in the vehicle.

2.12.1 The arrangement can be checked with the following graduated disks:
1 688 132 020 (EFEP 603) at the left rear throttle valve connection
1 688 132 021 (EFEP 604) at the governor control lever
1 688 132 022 (EFEP 606) at the right rear throttle valve connection

2.12.2 Set up the graduated disks on the appropriate control levers.
Attach pointer to the throttle valve connection at the rear fastening nut, and to the governor under the top left fastening screw of the start solenoid and set to 0° by bending.

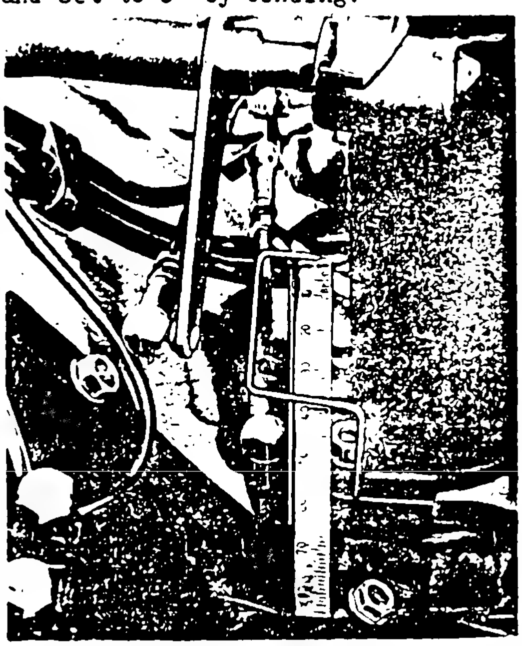

Fig. 5 - Fastening the graduated disk (throttle valve connection rear left)

2.12.3 Operate accelerator pedal linkage by hand and ascertain whether the values obtained agree with those listed below.

Graduated disk Governor	Graduated disk Throttle valve connection	max. deviation
0°	0°	0°
10°	6°	0.5°
40°	30°	0.5°
70°	65°	2°
Stop	82°	2°

The maximum deviations must not be exceeded. Should a deviation arise, it is possible to carry out a limited correction at the lever fitted on the left side of the transfer shaft. To do this, loosen the hexagonal nut and move the lever in its slot within the play available.

If more deviations arise when testing is resumed, check the lengths of the linkage (see para. 7.1) and check the linkage and control lever for distortion and bearing play. If necessary, replace damaged parts.

2.13 Testing the injection valves:

2.13.1 The injection valve test is carried out on the BOSCH nozzle tester 0 681 143 016 (EFEP 345 A) or 0 681 143 013 (EFEP 60..) with pressure gauge; 1 687 231 015 (EF 137/29, 0...25 kgf/cm^2 (0-356 psi)). Test oil 01 61 v 11 (outside Germany use Shell "Calibration Fluid B").

2.13.2 Nozzle opening pressure: The nozzle opening pressure must be 13-18 kgf/cm^2 (185-256 psi). The injection valves of one engine, however, must not vary by more than 3 kgf/cm^2 (42.7 psi).

When testing the nozzle opening pressure, first pump the system through 2-3 times vigorously with the pressure gauge out of circuit so that any air in the system can escape.

2.13.3 Spray shape:

The spray shape should be an even cone. Valves which show a marked tendency to spray more on one side should be replaced.

2.13.4 Leaks:

Pump the system through 2-3 times vigorously with the pressure gauge out of circuit. Switch in the pressure gauge. At a pressure 2 kgf/cm^2 (28.4 psi) below the opening pressure and with the valve in an oblique position 30 - 45° from the vertical no drops may form within 15 seconds.
If these conditions are not fulfilled, see whether the situation can be improved by pumping the system through vigorously again. If not, replace the valve. The injection valves of an engine can also be replaced individually.

3 Removing the pump

3.1 Before removing the pump set the engine to port opening (FE):
To do this, screw out all the spark plugs, remove the distributor cap of the ignition distributor. Using the pulley turn the engine crankshaft over in engine rotation direction until the port opening mark (FE) on the pulley is aligned with the setting mark on the engine housing. The distributor rotor must now lie 20° behind cyl. 4. If this is not the case, using the pulley turn the crankshaft through one more turn (360°). The engine now lies 40° after TDC of cyl. 1 = port opening.

3.2 Loosen the fastening clips of the air filter (4 on each side), pull off hoses from the air filter and remove it.

3.3 Pull off both cables from the microswitch (at the left rear intake manifold - viewed in driving direction).

3.4 Remove tie-rods between transfer shaft and the last throttle valve connection on the right and left, between transfer shaft and governor and between transfer shaft and transfer lever at the first throttle valve connection on the left.

3.5 Screw off the 6 fastening nuts (10 mm/25/64 in) on the flanges of the left intake manifolds (using Porsche special tool P 231 B if necessary). In the case of vehicles with Sportomatik screw off the control valve at the first throttle valve connection or intake manifold on the left, pull off the hoses while at the same time releasing the clamping rings and place the control valve on one side. Remove the left intake manifold assembly and at the same time pull the transfer shaft out of its bearing on the rear intake manifold on the right. Place intake manifold assembly together with transfer shaft on one side. Take care that no washers or dirt fall into the open throttle valve connection. Immediately cover open throttle valve connection.

3.6 Remove cables from start and shut-off solenoid (gray cable = start, gray/red cable = shut-off solenoid).

3.7 Unscrew the delivery lines at the injection pump, prevent rotation at the delivery valve holder by holding with a 19 mm (3/4 in A/F) open box wrench.

3.8 Unscrew fuel inlet line (right) and fuel return line. Caution: Fuel escapes! Fasten hoses end-upwards.

3.9 Remove oil inlet and return lines from the injection pump. When unscrewing the inlet line (below) oppose rotation with an open end wrench at the connecting fitting on the pump housing. Loosen hose clamp at return hose and pull off hose from connection on spring compartment cover. A small amount of oil may escape from the pump.

3.10 Unscrew the fastening nuts of the injection pump. Remove washers (using jointed socket wrench, Porsch special tool P 120 B, if necessary).

3.11 Unhook toothed driving belt from the driving gear and hook it up immediately with a rubber band. If the belt remains slack or falls down it may slip from the gear on the cylinder head camshaft and it cannot be replaced from above.

3.12 Lift the injection pump from the mounting bracket and remove. Caution: On no account may the pump be grasped by the altitude capsule when being removed.

4 Installing the pump:

Install the pump in the reverse order to that used when removing. The following points should be borne in mind:

4.1 Check port opening (FE) position of the engine (see para. 3.1).

4.2 Lay pump on its side and fill with 300 cm^3 oil (as used in the engine) through the oil return connection in the spring compartment cover.

4.3 Use the drive gear to turn the camshaft so that the mark on the drive gear hub is in line with the mark on the pump bearing bracket.

4.4 After placing the pump in position and fastening lightly with the 4 fastening nuts, push the toothed belt onto the driving gear.
If this cannot be done because the teeth are not properly aligned, take out the pump again and rotate the gear ring of the driving gear after loosening the three hexagonal socket screws on the hub.

4.5 After placing the pump in position, tension the toothed belt. To do this, shift the pump towards the right along the slots using Porsche special tool P 234 B which should be inserted between the pump housing and the beading of the mounting bracket. It should be possible to depress the toothed belt approx. 6 - 8 mm (15/64 - 23/64 in) in the middle.

4.6 Again check whether the marks on the gear hub and the bearing bracket are aligned, correcting, if necessary, in accordance with para. 4.4. This check is simplified by holding a mirror at an angle over the gear.

4.7 Once the pump installation is completed the positioning of the pump in relation to the throttle valve connection should be checked in accordance with para. 2.12.

4.8 After allowing the engine to run for a short while, check the entire injection system for leaks.

5 <u>Changing the toothed belt</u>

5.1 Set the engine to port opening (FE).

5.2 Remove heat exchanger from the left-hand side of the underside of the engine.

5.2.1 Loosen the hose clamp of the hose from the heat exchanger to the heating flaps control box at the heat exchanger connection and pull off hose.

5.2.2 Loosen the hose clip of the hot-air hose to the warm-up thermostat of the governor and pull off hose.

5.2.3 Screw out hexagonal socket screws (long hexagonal socket wrench necessary, 8 mm (5/16 in A/F)) and hexagonal nuts on the exhaust flanges on the cylinder head.

5.2.4 Remove the through screws at the exhaust muffler flange.

5.2.5 Screw out the small fastening screw (10 mm - 25/64 in A/F) at the mounting bracket on the engine casing.

5.2.6 Lift off heat exchanger.

5.2.7 Unscrew the cover plate over the toothed belt (4 screws, 10 mm - 25/64 in A/F).

5.2.8 Loosen the pump fastening nuts and shift the pump in the slots towards the left using Porsche special tool P 234 B.
<u>Caution</u>: Altitude capsule must not contact the inlet manifold tray.

5.2.9 Remove old belt.

5.2.10 Hook up the new toothed belt near the pump driving gear using a rubber band. Push the belt down through the gap between chassis and engine and place on the gear of the cylinder head camshaft.

5.2.11 Push toothed belt onto the pump driving gear.

5.2.12 Tension the toothed belt by shifting the pump towards the right and check the pump-engine setting (see paras. 4.4, 4.5 and 4.6).

5.3 Remount the heat exchanger in the reverse order. Renew all gaskets at the exhaust flanges.

6. Removing and installing the delivery lines

6.1 When installing or removing the delivery lines, remove the corresponding intake manifold assembly on the right or left (see para. 3).

6.2 When loosening or tightening the delivery lines at the pump, oppose rotation at the delivery valve holders and also at injection valves with an open box wrench (19 mm = 3/4 in A/F).

7. Adjustment

7.1 Adjusting the linkage lengths:
When replacing or readjusting the linkage, the linkage length is to be observed exactly and if necessary readjusted (Fig. 6).

Push-rod 1 from ball joint center to ball joint center = 114 mm ($4\frac{31}{64}$ in)

Push-rod 2 from ball joint center to ball joint center = 275 mm ($10\frac{53}{54}$ in)

Push-rod 3 from ball joint center to ball joint center = 149.5 mm ($5\frac{7}{8}$ in)

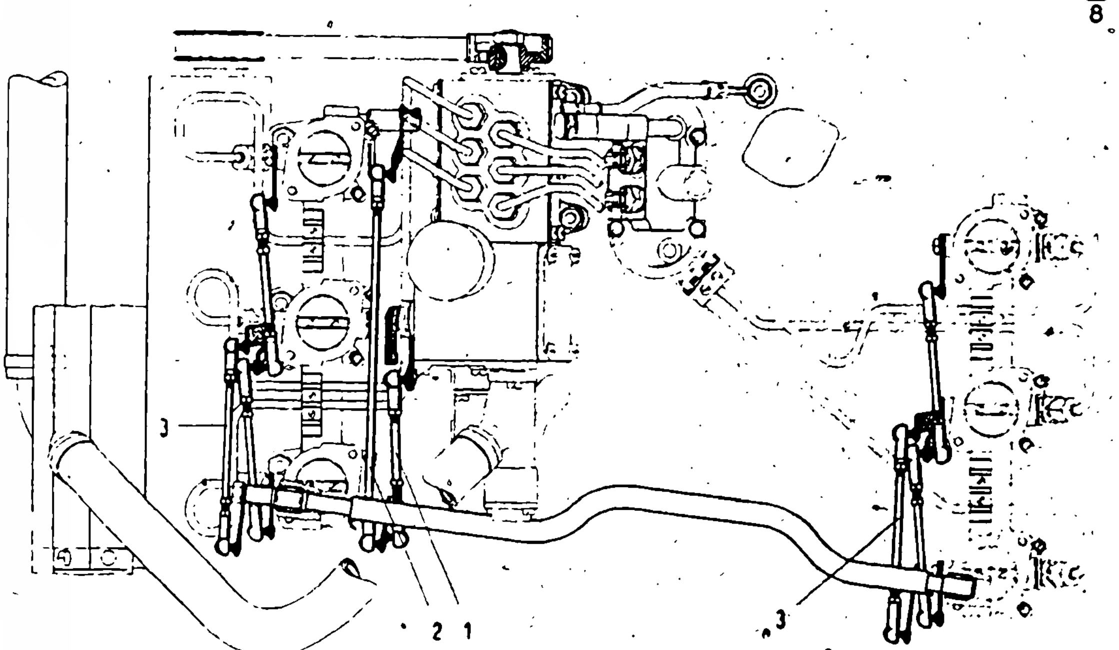

Fig. 6 - Arrangement of linkage

Next check the arrangement (para. 2.12).

Caution: The linkages between the individual throttle valve connections are sealed with laquer and must not be altered.

7.2 Adjusting the microswitch:

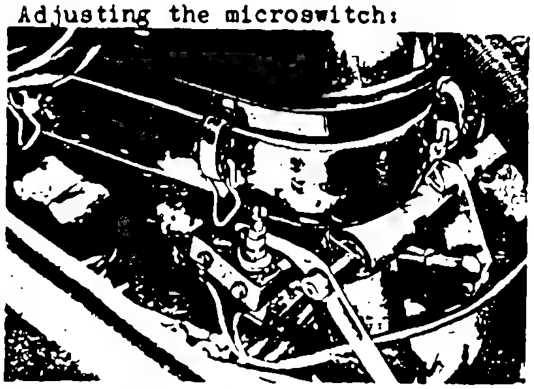

Fig. 7 - Microswitch

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7.2.1 First screw out the adjustment screw until the microswitch is not bridged in the idling position.

7.2.2 Slowly screw in the adjustment screw again until the microswitch is just bridged (the bridging action is audible).

7.2.3 Lock adjustment screw in this position.

7.2.4 Place graduated disk 1 688 132 020 (EFEP 603) on control lever of the left rear throttle valve connection, fit pointer and set to 0°.

7.2.5 Measure angle at which microswitch cuts out. The angle must be 1.5 ± 0.5° . If the angle is greater, the engine may shudder violently between the speeds at which the speed-dependent switch cuts in and out, if the angle is too small the exhaust "burble" increases considerably.

7.3 Setting idling speed:

7.3.1 Allow the engine to warm up (approx. 70° C / 158° F oil temperature).

7.3.2 Using Synchro-Tester (e.g. Moto-Meter "ST 100") check whether there is equal vacuum in each intake manifold. If necessary, adjust the idling-air screw in the throttle valve connection.

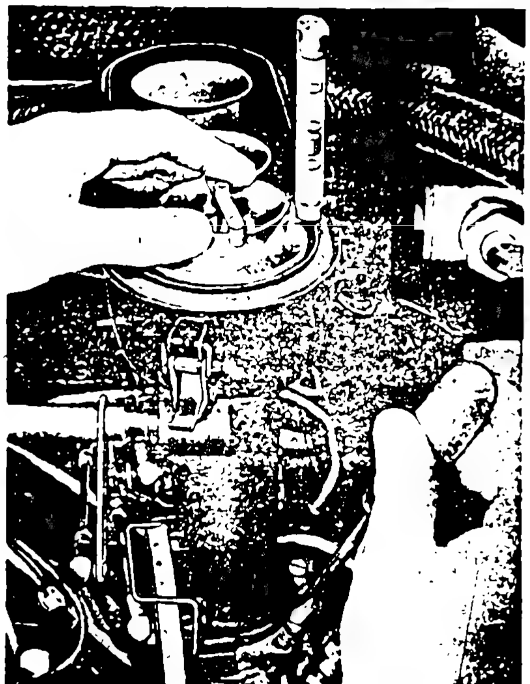

Fig. 8 - Setting the idling speed with the Synchro-Tester

7.3.3 Measure the idling speed; it must be 900 - 950 rev/min. Adjust by altering the idling quantity of the injection pump by means of the spring-loaded adjustment screw in the governor cover.

Caution: Only adjust the adjustment screw when the engine is at a stand-still. When adjusting with special spanner (Porsche special tool P 230 B) press in the adjusting screw until it engages.

If speed is too high turn adjustment screw counter-clockwise; if too low, turn clockwise. Do not adjust by more than one notch at a time. Maximum adjustment is only three notches to the right or left of the basic position.

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7.3.4 Connect exhaust gas tester according to the operating instructions and test the CO content of the exhaust gases (for CO values, see table).

Note: When carrying out the exhaust gas test on Porsche vehicles a different sampling probe is necessary for exhaust gas testers EFAW 109.. and EFAW 173.. .

Details about this special probe are given in a special information sheet.

If the CO content differs from prescribed value then correct by uniform adjustment of the idling air screws in the throttle valve connectors.

7.4 Testing the CO content under partial and full load:

In addition to the exhaust gas tester a roller test stand is necessary for testing the CO content under partial and full load (for CO values see table). See also para. 7.6.

7.4.1 Testing under partial load:

Fasten graduated disk 1 688 132 020 (EFEP 603) with pointer to the left rear throttle valve connection (see para. 2.12.2).
Fasten travel limiter (Porsche special tool P 232 B) to the pedal and limit the pedal travel so that the value given in the table is obtained on the graduated disk.
Allow the engine to warm up (approx. 70° C /158° F oil temperature).
Connect exhaust gas tester.

Drive vehicle on test stand in prescribed gear and with the throttle position set by the travel limiter (see table). Allow the test stand to brake the engine to the speed given in the table.
Read off the CO content from the exhaust gas tester.

7.4.2 Testing under full load:

Test the full load CO content as for partial load, but according to the full-load values in the table. Remove the travel limiter from the pedal.

7.4.3 If the partial-load and full-load values deviate equally from the nominal values, the prescribed values can be reached by adjusting the index screw in the control rod head (parallel shift of the characteristics curve). If only one value (partial or full load) is within the permissible tolerances, the pump should be removed for testing on the injection pump test stand.

7.4.4 After adjusting the control rod head the CO content should be checked again at idling speed and corrected if necessary.

7.5 Test points and exhaust gas values (CO content):

	Throttle valve position	Gear	Speed (rev/min)	CO content %
Idling	Idling stop	-	900-950	3.5 ± 0.5
Partial load	7°	II	2500	2.0 ± 0.7
Full load	Stop	V	3000	6.5 ± 0.7

7.6 Testing the CO content whilst driving.
It is only possible to road-test the partial-load values.

Caution: The full-load test may not be carried out because of overloading of the brakes and because of the high speed at the prescribed full-load test point (para 7.5).

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[redacted]

BMP 70118

Since the partial-load test merely indicates the setting of the partial-load spring the exhaust gas test as a road-test is of no value.

A viable road-test measuring procedure is at present being worked out and will be published as a supplement to this Technical Information Sheet.

The supplement will also contain details about a slight alteration to the available exhaust gas tester.

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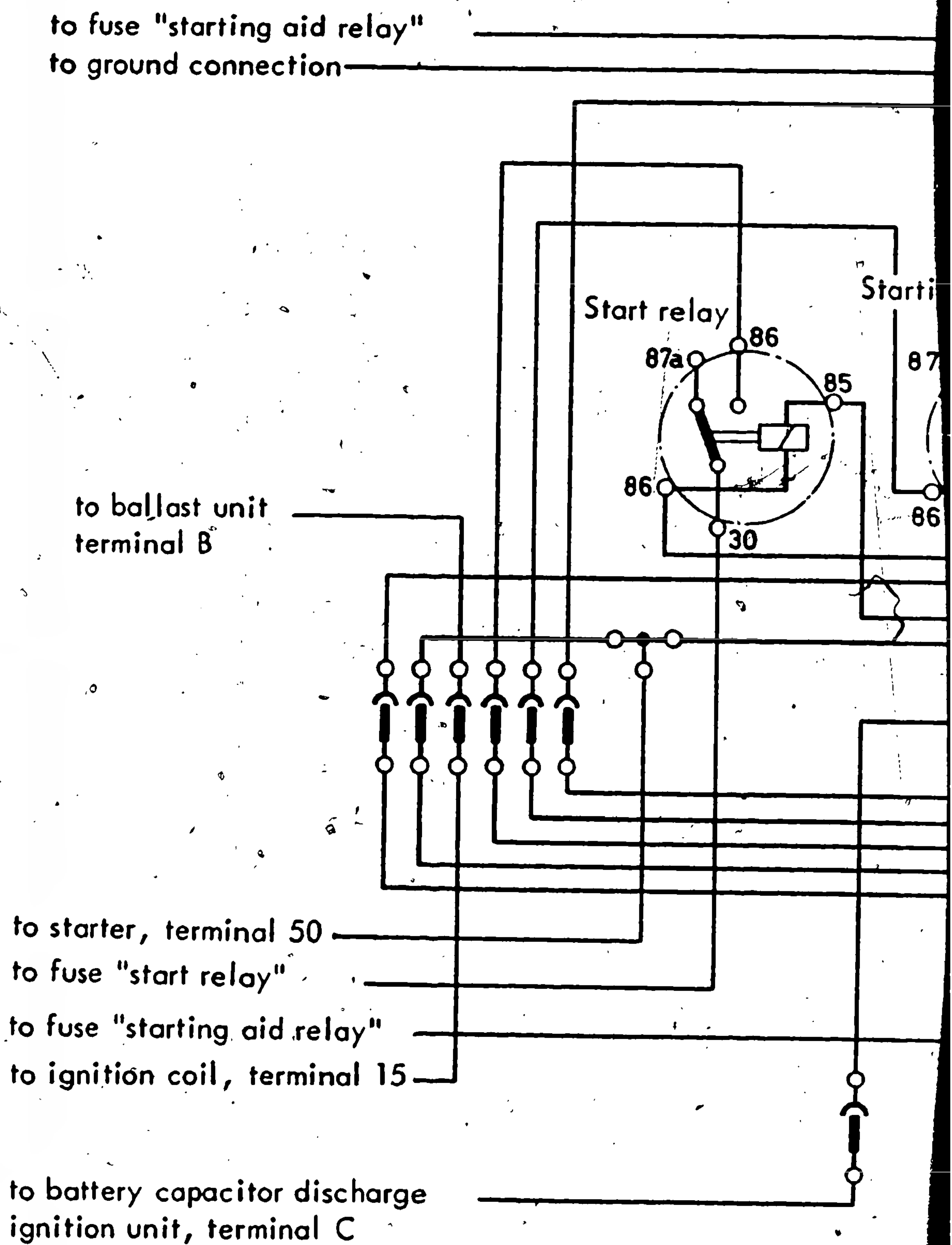

Fig. 9 - Electrical wiring diagram

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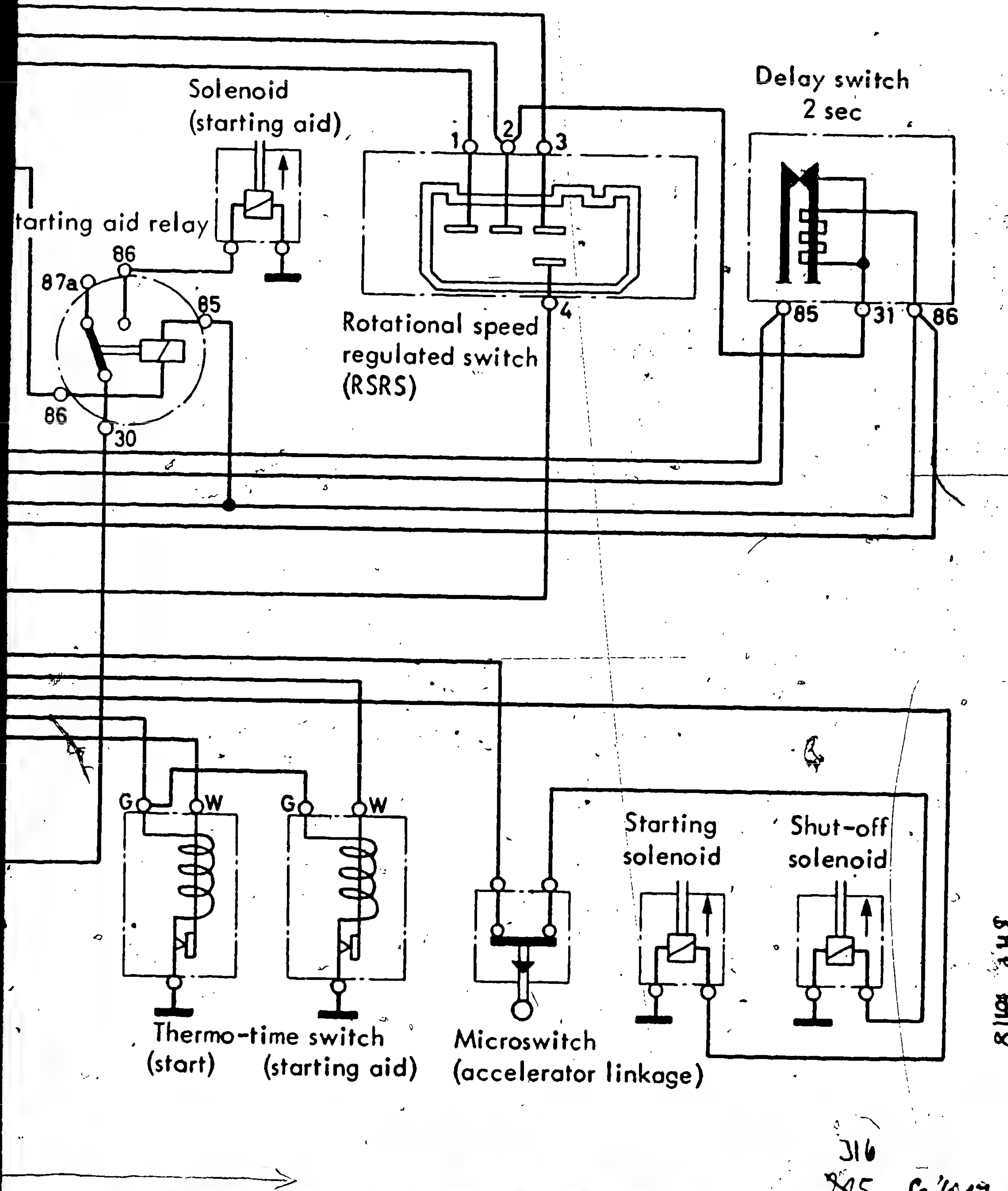


Solenoid
(starting aid)
Delay switch
2 sec
1
2
3
tarting aid relay
86
87a
85
86
30
Rotational speed
regulated switch
(RSRS)
4
85
31
86
G
W
G
W
Starting
solenoid
Shut-off
solenoid
Thermo-time switch
(start)
(starting aid)
Microswitch
(accelerator linkage)
J16

BOSCH TECHNISCHE MITTEILUNG

Kenntnis genommen:	Bearbeiter	Inhaber	Meister	Mechaniker
Noted by	Project Specialist	Owner	Supervisor	Mechanic

VDT-BMP 701/8 B EP A1
1st supplement
Edition 12.70
Translation of German edition of 24.9.70

Porsche "911 E and 911 S" model 69 (2.0 l engine)
model 70 (2.2 l engine)

Modifications to exhaust gas test

Destroy edition dated 5.70

To our foreign representatives

As from model 70 the Porsche vehicles mentioned above are equipped with a 2.2 l engine (engine type 911 E - C and 911 S - C).

As a result of this change-over a few modifications have been made to the fuel injection system of the 2.0 l engine in order to adapt it to the new engine (Section 1).

The exhaust gas values for the 2.0 l and the 2.2 l engines also differ. As a result of recent experience the method of exhaust gas testing has been revised and standardized for both engine types (Section 2).

1. The construction and method of operation of the fuel injection system for the above mentioned Porsche Vehicles with 2.0 l engines is described in VDT-BMP 701/8 B. The fuel injection system of the 2.2 l engine differs from that of the 2.0 l engine in the following respects:

1.1 The starting solenoid of the injection pump governor is no longer required. Therefore the same applies to the governor starting lever and shaft, the switching relay, the time switch and the thermo-time switch (for temperatures between +2°C/36°F and -25°C/-13°F). With the disappearance of the starting solenoid it was possible to alter the control rod head secured to the control rod into a non-resilient version with 12 instead of 6 indent positions for parallel displacement of the graph.

1.2 Start enrichment in the 2.2 l engine is produced by the starting device in the air cleaner, while that in the 2.0 l engine operates as an auxiliary cold starting device only between -10°C/+14°F and -30°C/-22°F. By the use of a suitable thermo-time switch the starting device is switched on at every starting operation until a temperature of 45°C/113°F is reached. The thermo-time switch for the 2.2 l engine is marked with the Porsche part number 911.617.117.00 and 45° on its hexagonal collar.

The injection tubes of the starting device in the air filter of the 2.2 l engine have an I.D. of 0.3mm/0.0118" (0.5mm/0.0197" in all 2.0 l engines and 2.2 l carburetor engines). The upper part of the air filter (metal housing and the more recent plastic housing) for the 2.2 l engine are recognisable by the widening at the connection for the fuel inlet (built-in micro-filter) and the additional connecting piece on the connecting elbow for the flame arrester. The air cleaner upper part for 2.2 l engines is labelled "E" for fuel injection engines or "V" for carburetor engines.

1.3 The starting point for warm-up enrichment has been raised to 53°C/127° F by placing a thicker spacing washer between warm-up thermostat and governor cover. This spacing washer is 1.62mm/0.0630" thick and is recognisable by its 5mm/0.1969" hole.

1.4 Owing to the alteration of the air supply to the oil cooler the fuel injection tubing of the 2.2 l engine is laid differently. The tubing is 660mm/26" long as compared to 700mm/27.5" in the case of the 2.0 l engine, therefore the injection tubing of the two engines must not be interchanged.

1.5 The M5 threaded bore on the drive side in the control rod of the injection pump is no longer present. The test for easy control rod movement can therefore no longer be carried out as described in VDT-BMP 701/8 B, Section 2.3. Instead, proceed as follows: Remove protective rubber cap and push back the control rod (towards the rear of vehicle) using a clean object (e.g. a piece of wood the thickness of a pencil). When released, the control rod must spring back to its original position of its own accord.

1.6 A number of the pumps produced for the 2.2 l engine had an adjustment screw for the stop of the governor speed control lever. The idling speed could be increased slightly during the running-in period of the engine by means of this adjustment screw, without it being necessary to alter the setting of the pump and idling air adjustment screws. This may no longer be done. When carrying out repairs the adjustment screw should be removed.

1.7 Function and test facilities of auxiliary components in the case of the 2.0 l engine remain the same. In the case of the 2.2 l engine the following points, which deviate from VDT-BMP 701/8 B, should be noted:

1.7.1 Section 1.2.2 "Start solenoid", 2.3 "Test function of start solenoid", 2.4 "Test time switch" and 2.5 "Test thermo-time switch for start solenoid" no longer apply.

1.7.2 Section 2.7 "Test the thermo-time switch of the auxiliary cold start device" is altered as follows: Pull off the connecting lead to the starting solenoid (on air cleaner) and connect to test lamp. Until the oil temperature reaches 45°C/113° F the test lamp must light up at every starting operation.

2. Preparatory work for the exhaust gas test:

During an exhaust gas test, the carbon monoxide (CO) content of the exhaust gases is measured. This CO content depends on the composition of the fuel/air mixture in the engine cylinders. This composition in turn depends on the general state of the engine (ignition system, valve clearances, compression, pressure losses, spark plugs, etc.), on the relationship between governor control lever and throttle control levers, as well as the effective ambient conditions (ambient temperature and induction air temperature).

> It is therefore absolutely essential to carry out the tests enumerated below before the exhaust gas test or, if this should prove impossible in your own workshop, to have these tests carried out by your local Porsche agency. All data are valid for 2.0 l and 2.2 l engines.

2.1 Valve clearances and timing

Incorrectly adjusted valve clearances result in incorrect valve timing and thus in insufficient combustion. The necessary technical data and instructions on valve clearance adjustment appear in the operating instructions accompanying the vehicle.
It is stressed that adjustment of valve clearances requires the utmost care because incorrect adjustment - especially insufficient clearance - may cause serious damage.

2.2 Compression or pressure loss

For this test we recommend the Bosch compression loss tester 0 681 001 900 - EFAW 210. Its operation is described in Operating Instructions VDT-UBP 101/2B. The compression in each cylinder should be 9 - 11 kgf/cm² (128 - 156 psi) with engine hot (60°C/140°F minimum oil temperature), uniform compression stroking rate and fully open throttles.
The pressure loss per cylinder must not exceed 10%. The values for all cylinders should be approximately identical.

2.3 Dwell angle and ignition timing

The dwell angle is 38° ± 3° at idling speed (850 - 950 rev/min). Ignition timing 0° - -2° at idling speed, 30° - 32° at 6000 rev/min.

2.4 Adjustment, pump - engine

2.4.1 End of delivery

Adjustment of pump and engine for end of delivery is described in VDT-BMP 701/8 B, Sections 3 and 4.

2.4.2 Relationships

The relationships of the control levers (governor control lever - throttle levers) is determined as described in VDT-BMP 701/8 B, Section 2.12. The table of measuring points has been extended as follows:

Calibrated disc on governor control lever	Calibrated discs on throttles	Maximum deviation
0°	0°	
5°	3°	
10°	6°	0.5°
15°	9.5°	
20°	13°	
30°	21°	
40°	30°	
50°	40.5°	
60°	52°	2°
70°	65°	
79-82° (end stop)	80-85°	

Until the value 30° is reached, there must not be any deviation between the two rows of throttles.
When adjusting the relationships, the hand throttle lever (between seats in cockpit) must be fully against its bottom stop.
If the above values cannot be achieved, check linkage lengths (VDT-BMP 701/8B, Section 7.1).
Subsequently or before handing over the vehicle, the adjustment of the hand throttle lever should be checked and corrected if necessary (4000 rev/min at full deflection, oil temperature 80°C/176°F).

Note:
The designation of the calibrated discs for adjusting the relationships has been altered:

Former designation		Present designation
1 688 132 020	(EFEP 603)	KDEP 2974
1 688 132 021	(EFEP 604)	KDEP 2975
1 688 132 022	(EFEP 606)	KDEP 2076

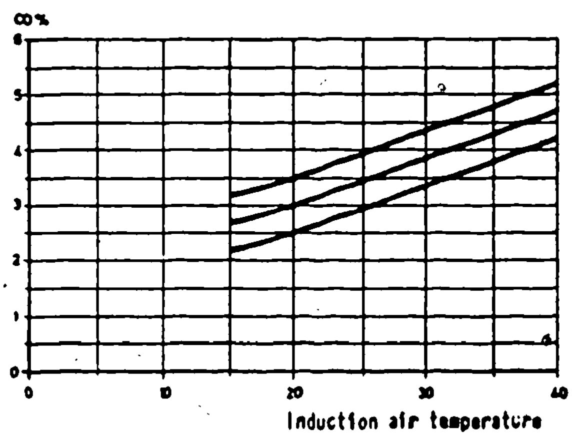
CO values as a function of induction air temperature

80° C (176° F) oil temperature

911 E

Idling

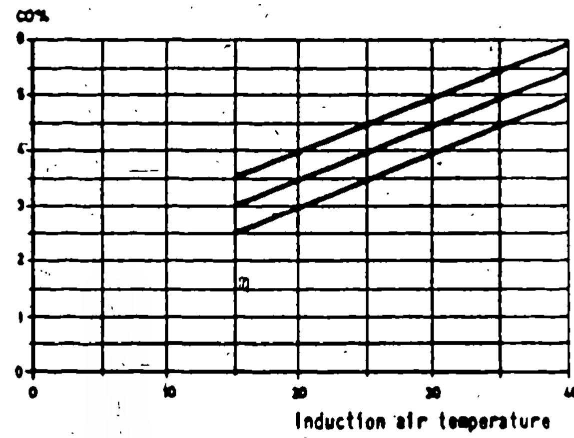
(900± 50 rev/min)



911 S

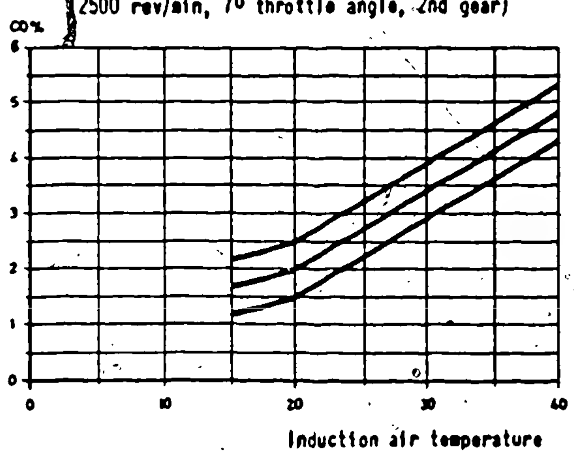
Idling

(900± 50 rev/min)



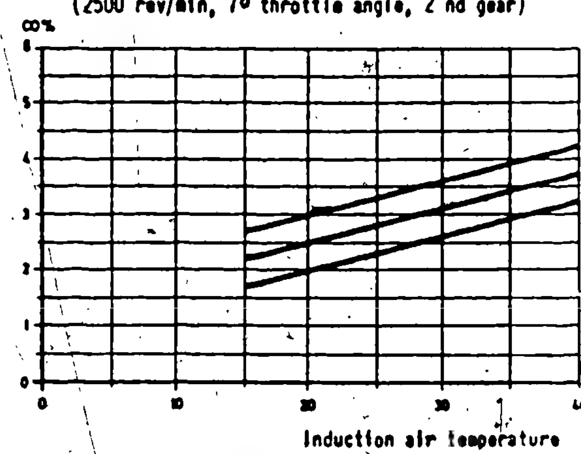
Partial load

(2500 rev/min, 7° throttle angle, 2nd gear)



Partial load

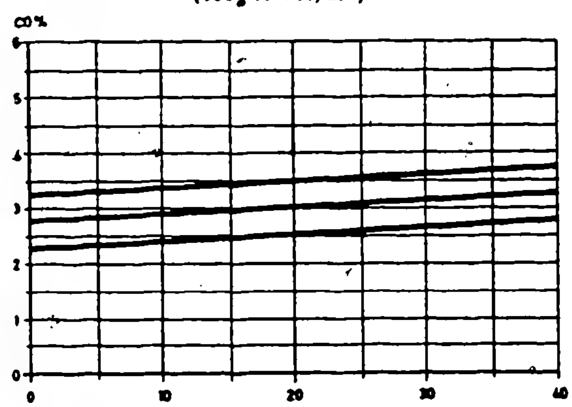
(2500 rev/min, 7° throttle angle, 2 nd gear)



CO values as a function of induction air temperature

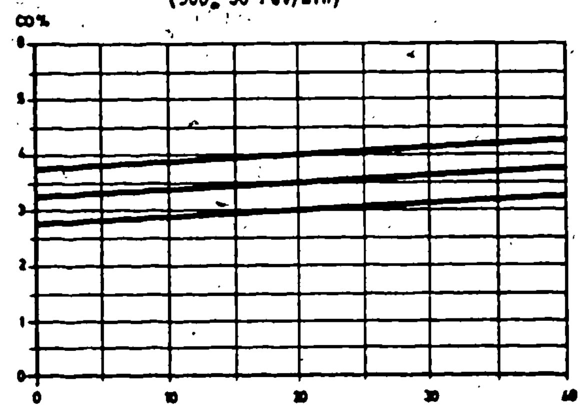
911 E-C

Idling
(900 ± 50 rev/min)

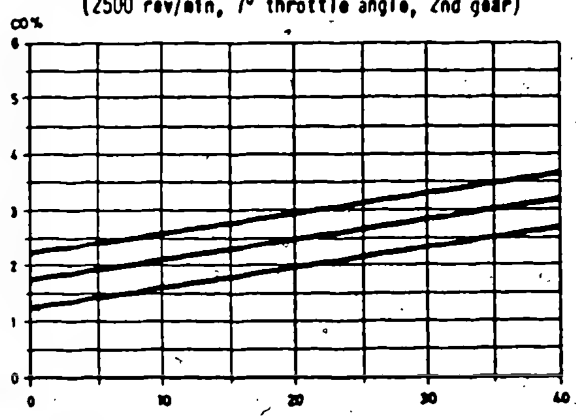


911 S-C

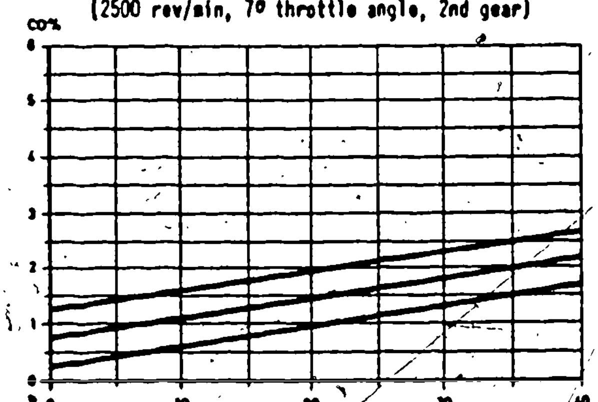
Idling
(900 ± 50 rev/min)



Partial load
(2500 rev/min, 7° throttle angle, 2nd gear)



Partial load
(2500 rev/min, 7° throttle angle, 2nd gear)



3. Exhaust gas test

3.1 The exhaust gas volumes given in VDT-BMP 701/8 B for the 2.0 l engine have been altered to some extent. The currently valid values for the 2.0 l engine and the new values for the 2.2 l engine are given below.

Exhaust gas values are seriously affected by engine oil temperature and induction air temperature.
The values are therefore shown in graph form as a function of induction air temperature and are valid only for an engine at working temperature (engine oil temperature 70 - 80° C/158 - 176°F).

Measurement of the CO content is carried out during idling and at partial load. The full-load measurement is no longer required. The partial load measurement can be carried out on a roller test stand or as a road test. For the road test a mains-independent exhaust gas tester is required, i.e. 0 681 169 072 - EFAW 109 or 0 681 000 200 - EFAW 173 (both testers are identical in design and function).

3.2 Measurement and adjustment of air passed by throttles in partial load range: For this measurement, Messrs. Porsche developed and produced a vacuum tester, "Porsche special tool P 235". Any enquiries about obtaining this instrument should be directed to your Porsche agency.

Measurements are carried out as follows:
Run engine up to normal working temperature (60°-80°C/140°-176°F). Using hand throttle lever set engine speed to 2800 rev/min.

Insert rubber plugs of measuring instrument consecutively into the individual induction ports, and set the vacuum (liquid column height) of all cylinders to the same value by turning the idling air adjustment screws.

The idling adjustment using the synchrotester as described in VDT-BMP 701/8 B in Section 7.3.2 no longer applies.

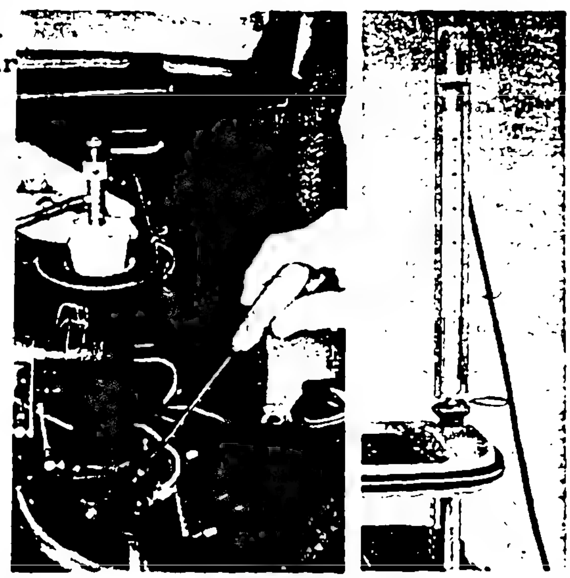
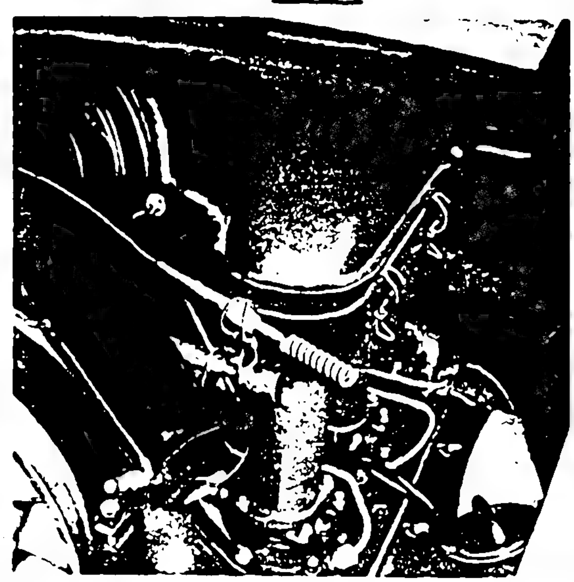


Fig. 1

3.3 Check CO content at partial load (see diagram, Section 3.1, for CO values). Place air cleaner in position. Connect the remote thermometer for measuring the induction air temperature. For this purpose we recommend Porsche special tool P 237; enquiries about obtaining this thermometer should be directed to your Porsche agency. The thermocouple of the remote thermometer is secured near to the air cleaner manifold (not <u>in</u> manifold), for example, with one of the air filter clips (see Fig. 2).



J22

JM 322 A22

The connection line of this remote thermometer should then be secured to the vehicle body using adhesive tape and should be taken into the cockpit through a rear side window. Install indicator instrument in cockpit in a position where it can be observed from the passenger seat.

Fit calibrated disc KDEP 2974 (formerly 1 688 132 020 - EFEP 603) to the L.H. rear throttle valve housing and set the throttle opening angle given in the diagram.

The movement limiter (Porsche special tool P 232 B) prescribed in BMP 701/8 B, Section 7.4.1, to be attached to the accelerator pedal in order to lock the throttle position has proved to be disadvantageous for road testing (no possibility of rapid acceleration when required by traffic situation). Therefore a device has been brought out (Fig. 3). which is attached to the governor speed control lever stop and does not affect the movement of the speed control lever in the direction of full load. The device can easily be made in accordance with sketch 1 on page 8. The prescribed throttle position is set with the adjustment screw.

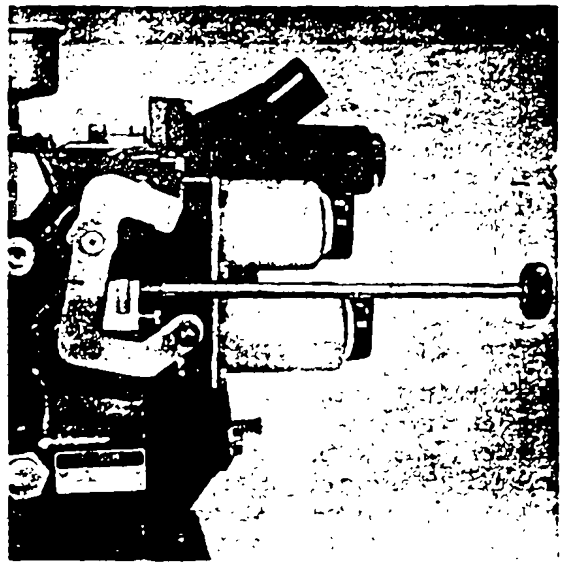


Fig. 3

Connect exhaust gas tester (EFAW 109 or EFAW 173) in accordance with the operating instructions. In order to avoid time lags while measuring, the measuring instrument should be set up as close as possible to the sampling probe. For this we recommend making a rack in accordance with sketch 2 on page 8. The rack is hooked over the engine cover plate on the same side as the exhaust pipe; as a result the engine hood cannot be closed during the test. Carefully fasten the measuring instrument securely to the rack (with elastic luggage harness, for example). Keep the hose between sampling probe and measuring instrument as short as possible. Set up the indicating instrument in the cockpit so that it can be observed by the passenger (Fig.5). Secure current supply cable of indicating instrument to the body using adhesive tape and pass through one of the rear windows into the cockpit.

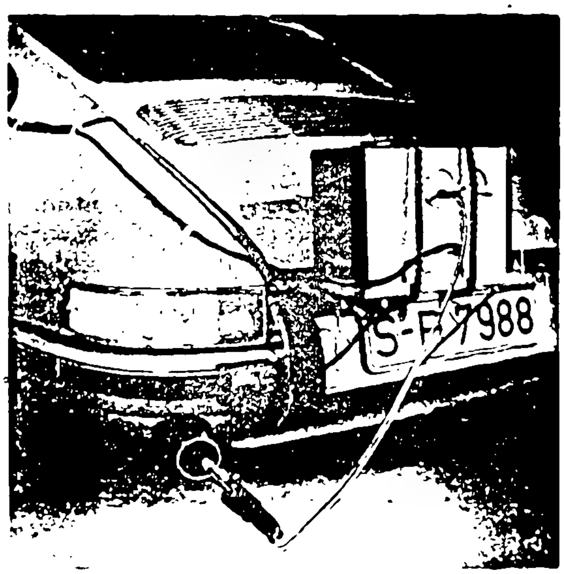


Fig. 4

Insert the sampling probe in the exhaust pipe such that the water trap hangs at an angle of approx. 45° (Fig. 4, in vertical position there is the risk that the water trap will hit the road when the vehicle "bottoms").

Note: The earlier exhaust gas testers EFAW 109 and EFAW 173 were supplied with mounting clamp 1 688 040 033 - EFAW 109/16 for sampling probe. This clamp is not safe enough when used to secure the probe obliquely during a road test (accident risk).

The clamp 1 688 040 041 - EFAW 109 A/16 now supplied allows safer probe clamping. This clamp can be obtained singly (both clamps are for 9mm (3/8") dia.probes).

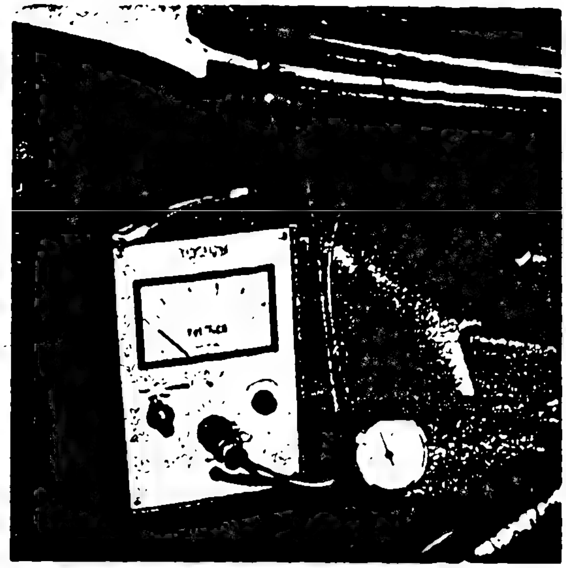


Fig. 5

Drive vehicle with specified gear and throttle setting (partial load).

When road testing please note the following:
The instruments (remote thermometer and indicating instrument of the exhaust gas tester) should be observed by the passenger. Loading (braking to prescribed engine speed) is carried out by means of the service brake. A slight downhill gradient should be selected for the test, and every repeat measurement should be made over the same stretch of road.

Since the engine speed is set high as a result of the throttle setting, it is advisable to start the engine with the gear engaged (see diagram for gear required) and the clutch disengaged and to start off in this gear.

> To preserve the brakes, the specified speed should be maintained right from the acceleration stage (i.e. do not run engine up to high revs and then brake down from a high speed).

If necessary, correct the CO content by turning the index screw on the control rod head of the injection pump - counterclockwise for a richer mixture and clockwise for a leaner mixture.
Adjustments should be carried out as quickly as possible to ensure that the induction passages do not heat up. Before any further measurement (on roller test stand or road) drive vehicle over a short distance or run at higher speed (approx. 3000 rev/min) so that the induction passages can cool down.

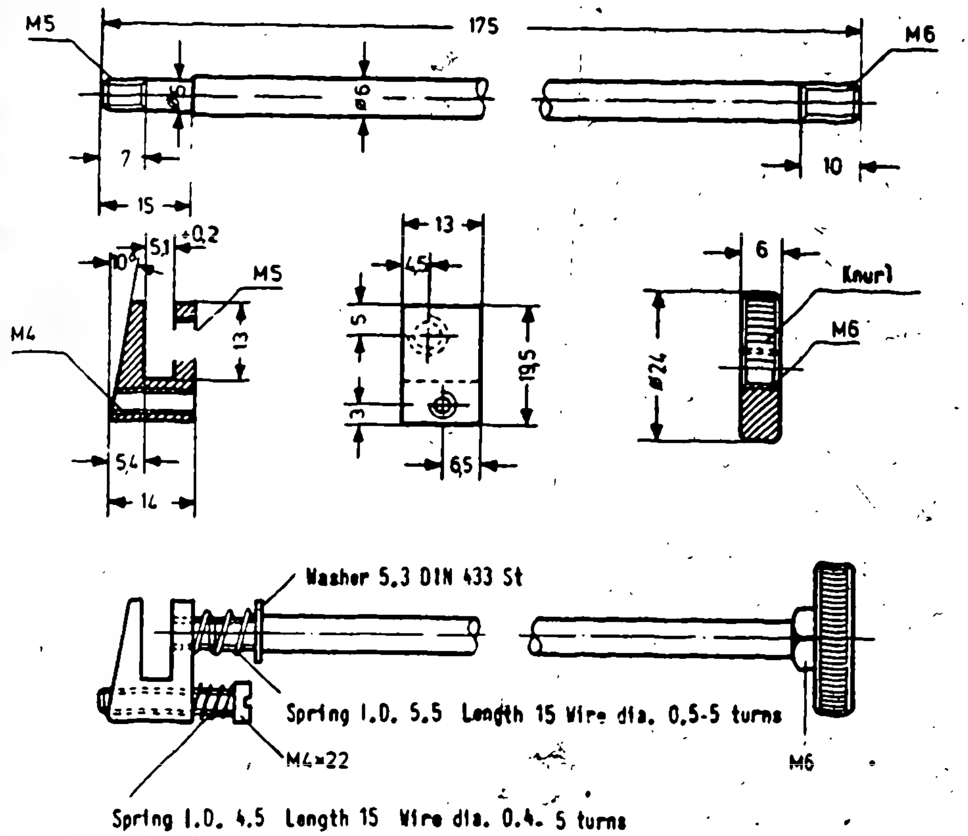
3.4 Idling adjustment

Adjustment of the index screw on the control rod head changes the injection volume - and thus the CO content - in all ranges of the characteristics graph (parallel displacement of graph). For this reason an idling adjustment must be made after every modification (see diagram for values).

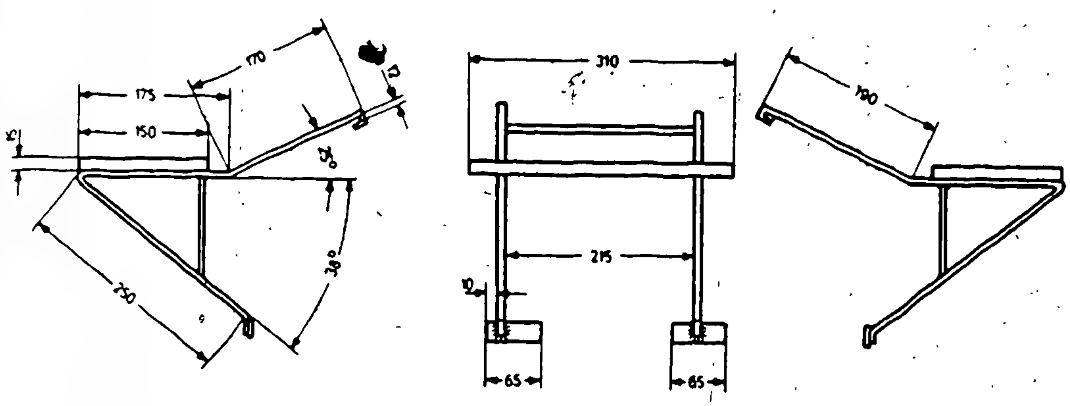
The adjustment with the "Synchro - Tester" (VDT-BMP 701/8 B, Section 7.3.2 no longer applies.

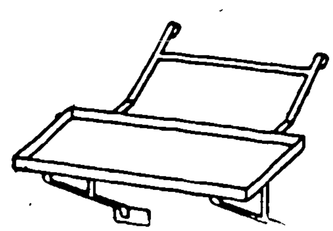
Measure idling speed. If the prescribed value is exceeded or is not reached, the idling air adjustment screwson the throttles should be uniformly reset as necessary. Screwing in produced a lower speed and screwing out has the opposite effect. Subsequently, measure CO content and if necessary adjust spring-loaded adjustment screw in governor cover in accordance with values in diagram (Section 7). If the CO content is too high, turn adjustment screw counterclockwise or if content is too low turn screw clockwise.

Caution: Only turn adjustment screw with engine at a standstill. Do not adjust by more than one index notch at a time. Use Porsche special tool P 230 B for adjustment. If the idling air adjustment screws had to be reset to obtain the correct idling speed, the air throughput for the individual cylinders must be checked once more at 3000 rev/min using the vacuum measuring instrument (Porsche special tool P 235). If necessary, the air adjustment screws must be reset to a new average value (see Section 6.1).



Sketch 1





Sketch 2

BOSCH Technische Mitteilung

Kenntnis genommen: Noted by:	Bearbeiter Project specialist	Inhaber Owner	Meister Supervisor	Mechaniker Mechanic

Porsche 911 E and 911 S, 911 T - USA Version
Modification to the linkage adjustment on all models (69, 70, 72)

Model 72, modification to fuel system and to injection system

VDT - BMP 701 / 8 B
3th Supplement
Ed. 6.1972
Translation of the German edition of 14.4.1972

EP 41

To AV, AV/S

1. The relationship between throttle valve and governor control lever is greatly influenced by the thermal expansion of the engine. It is therefore necessary to make the checks and adjustments of the linkage when the engine has reached operating temperature (oil temperature 75° C to 85° C).
   At this temperature all control levers (throttle and governor) must rest exactly on the stops.
   All tie rods (push-rods 1, 2 and 3, see BMP 701/8 B, Section 7.1) must be able to be put in place stress-free.

   After this adjustment the governor control lever is slightly advanced when the engine is cold. This means that, while the throttles rest on the stops, the governor control lever has been raised about 0.5 - 1°.

   Adjustment of the linkage lengths (at 75 - 85° C oil temperature):

1.1. Push the hand throttle lever (between passenger compartment seats) all the way in.

1.2. Adjust the Nr. 1 push-rod to 114 ± 0.2 mm (ball-joint center to ball-joint center) and attach.

1.3 Attach both Nr. 3 push-rods to the throttle valves and adjust so that they can be placed stress-free on the shift lever.
All control levers must now rest exactly on their stops.

Perform the adjustment on each Nr. 3 push-rod separately. (Opposite rod removed in each case)

The length difference between the two Nr. 3 push-rods must not exceed 5 mm.

1.4. The length of push-rod Nr. 3 need no longer be measured. It must be possible to place it in position stress-free.

1.5. Check the relationship as before. The test-point table in BMP 701/8 B, 1st supplement remains valid (also for 2.4 l-engines).

J26

During adjustment on 2.4 l engines, various changes must be taken into account (amongst other things, a new graduated disc). See Section 2.

Note: On vehicles with air conditioning, the compressor in the engine compartment must be removed from the bracket so that the graduated disc can be introduced to the right-hand throttle control lever.
Do not remove the hose connections on the compressor.

1.6. Check the hand throttle. An engine speed of 4000 rev/min must be achieved with a hot engine and hand throttle lever fully out.

1.7. With the engine stationary and with the gas pedal fully depressed the control lever should be approx. 1 mm from the limit stop. Correction by means of the gas pedal stop screw.

2. The 2.4 l engines on the Porsche 72 series have several modifications compared to the 2.2 l engines which must be taken into account when checking and adjusting the injection system.
All of the modifications where the 2.4 l engine deviates from the data in the Technical Information VDT-BMP 701/8 B and 1st. Supplement are described below. In all other respects, the mentioned Technical Information sheets are valid.

2.1. <u>Mixture control governor</u>

A wide 3-D cam and a new follower lever (replaces the roller lever) have been built into the injection pump mixture control governor.

This modification affects the assembly and testing of the governor only. For assembly and adjustment notes see VDT-WJP 711/1 B, 1st. Supplement and VDT-WPP 711/1 B, 2nd. Supplement.

2.2. <u>Adjustment of the control lever</u>

The air throttle valve stops are located on the lever side on the 2.4 l engine. The control levers (modified at the same time) require a new graduated disc for checking adjustment and for the emission test.

The graduated disc fits each of the air throttle valve banks and is available from the authorized Porsche representative under the Porsche nomenclature P 228 c in two types.
The graduated disc KDEP 2975 will continue to be used on the governor control lever.

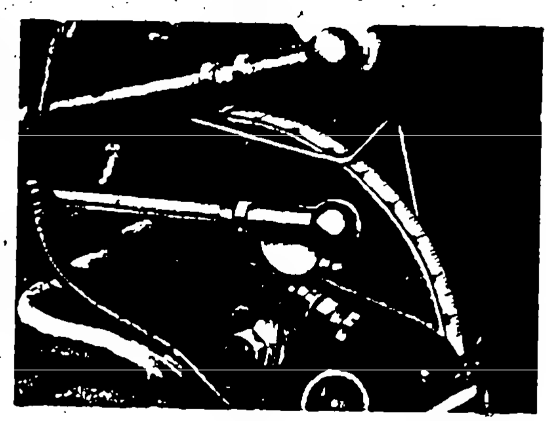


Fig. 1

2.3. <u>Measuring air flow rate at part load</u>

The induction pipes are plastic. They constitute a complete unit together with the air filter lower section and the intake pipes from the air filter.

A new rubber cone P 235 a is necessary with the Porsche vacuum tester P 235 for measuring the throttle valve air flow rate in the part load range. This special tool is also available through the authorized Porsche representative.

2.4. Cold-start device

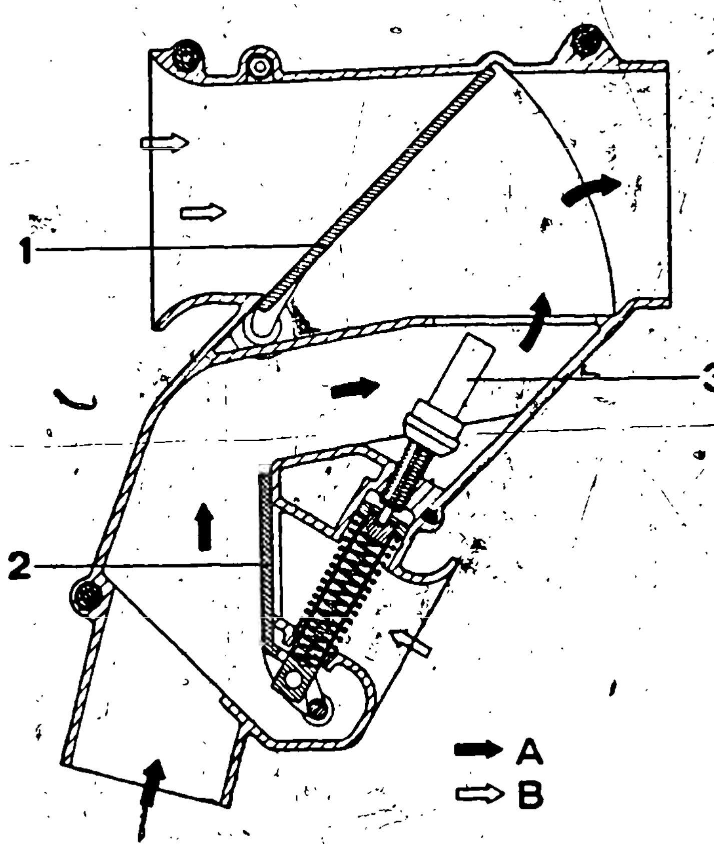
The cold-start device has also been modified on the 2.4 l engine. Instead of the injection tubes in the air filter housing, the induction pipes now contain injection nozzles which are fixed with adhesive. These injection nozzles are not replaceable.

Wiring and design of the cold start device has not been altered from the 2.2 l engine.

2.5. Intake air preheating

The 2.4 l engines run on preheated intake air in the lower rev/min range. For this purpose, a control unit with regulating valve is fitted to the air filter inlet tube and is connected to the heat exchanger by a delivery hose.

The construction of the control unit is seen in Fig. 2.



1 = fresh-air valve
2 = warm-air valve
3 = thermostat

A = warm air
B = fresh air

Fig. 2

The control unit is screwed to the left rear induction pipe.
The fresh-air valve is controlled by the control lever as a function of the throttle valve position.

The control of the warm-air valve is by an expansion element in the control unit.

1 Control unit
2 Warm-air delivery hose
3 Control lever

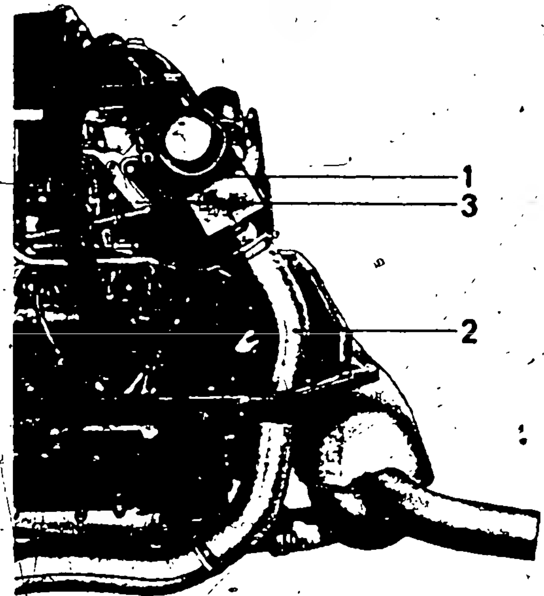


Fig. 3

Function:

Fig. 2 shows the position of the valves in the control unit housing with a cold engine at idle. The engine sucks warm air by way of the heat exchanger.

As intake air temperature increases, the expansion element closes the warm-air valve somewhat and opens the small air intake.
In this way, the temperature of the intake air is controlled to approx. 45° C. Independent of the warm-air valve position, the fresh-air valve will be opened by the control lever curved disc when the air throttle valve angle is greater than 20°. At the same time the intake of warm air is stopped. This causes the engine to suck in only fresh air in the upper part load range and at full load.

Functional check of the warm-air valve:

The warm-air valve must be open on a cold engine. A check can be made through the opening on the side of the control unit. The warm-air valve must close this opening and when closed be under spring tension.

Idle the engine at approx. 2,500 rev/min. After about 3 minutes, the warm-air valve must have lifted noticeably from the side opening.

If the warm-air valve doesn't work, the control unit should be replaced (the expansion element in the control unit cannot be removed).

Fig. 4

Adjusting fresh-air valve:

The adjustment of the air throttle valve rod is carried out at idle. The roller on the fresh-air valve lever should be adjusted by means of the two hexagonal nuts so that it rests on the contact surface of the curved disc without any play. With this adjustment, the fresh-air valve begins to open at an air throttle valve angle of about 20°.

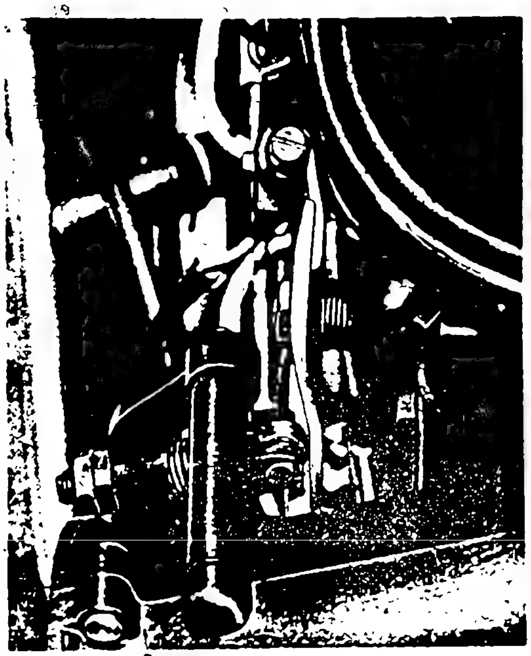


Fig. 5

2.6. Emission test

Because of the intake air preheating described under 5., measurement of the intake air temperature is not necessary during the emission test.

See table below for 2.4 l engine emission specifications.

Part load emission test:

Air throttle valve position:	9° (using Porsche special tool P 288c. Attach on right throttle housing or on left if air conditioning is built in).
Gear:	2nd
Revolutions:	2,400 rev/min (to reach this value decrease engine speed, do not increase it)

Emission Specifications

Part load Model	USA	Europe
911 T (USA)	1.5 - 2.0	-
911 E	2.0 - 2.5	2.0 - 3.0
911 S	2.0 - 2.5	2.0 - 3.0
Idle All models	2.0 - 2.3	2.5 - 3.5

K2

2.7. Adjusting the microswitch

Loosen lock nut. Unscrew the adjusting screw far enough so that the microswitch is not operated at idle.

Screw the adjustment screw back in until the microswitch activates (audible click).

Now screw the adjustment screw in 1/4 of a turn and lock.

Attention: The microswitch should be readjusted after every adjustment to the operating linkages of the air throttle valves and governor control levers.

2.8 Ignition distributor

Distributors with dual-diaphragm vacuum advance mechanisms are fitted to the 2.4 l engines. See Test Specifications Sheets for adjustment data.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K-Ausrüstung
Handel
Kundendienstschule

BOSCH

REPAIR INSTRUCTIONS

40

VDT-WJP 711/1 B Suppl. 2
Ed. 1

VDT

Gasoline Injection Pump with Mechanical Mixture Control Governor

0 408 126 ..
PED 6 KL 60/120 R 3 ..

Modifications to the mixture control governor EP/RLA.. for Porsche 2.4 liter engines.

A wider 3-D cam and, instead of the roller lever with follower roller, a follower lever with follower ball is fitted in the above mixture control governor.
A guide groove has been milled into the collar of the follower lever. When installed, a guide bolt pressed into the pump housing engages this groove. In this way, the center position of the follower lever is precisely located and cannot be altered.
The retainers on the lever shaft, the spring and the adjusting screw previously installed in connection with the roller lever have been eliminated.

When repairing this type of governor, the steps described in the Repair Instructions VDT-WJP 711/1 B Ed. 2 (12.70) for Figures 30, 31 and 32 do not have to be carried out.

In this case, the following text is valid for Fig. 33: Screw out the screw plug.
Take the lever shaft out through the screw plug opening and remove the follower lever.

The repair step for Fig. 57 does not have to be carried out.

Differing from Fig. 59 and its text, the follower lever is so fitted that the guide bolt pressed into the pump housing engages in the collar guide groove.
Insert the lever shaft into the governor housing and the follower lever collar. Screw the screw plug into the governor housing.

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50 (6 72)
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei

K4

A3 K4

040127 . .
Faults on the roller tappet in the fuel-injection pump PES . . A . . of the 3000 series fitted by CASE and John Deere

In the fuel-injection pumps listed below (date of manufacture FD 721 - 726) it can occur that the roller of the roller tappet cracks.

The following are affected:

Injection-pump assembly	with injection pump	fitted by
0 401 274 007	PES 4 A 95 D 420 LS 3023	CASE
276 027	PES 6 A 95 D 420 LS 3024	CASE
029	3024	CASE
034	3024	CASE
036	PES 6 A 100 D 420LS 3024	CASE
041	3024	CASE
043	3024	CASE
037	PES 6 A 100 D 410RS 3025	John Deere
039	3025	John Deere
040	3026	John Deere
042	3025	John Deere
044	3027	John Deere
048	3027	John Deere

The rollers have already been replaced in the case of pumps identified by a letter ("A", "B", "J" or "F") on the top side of the pump between the delivery-valve holders for cylinders 2 and 3 or 4 and 5, or in the case of pumps marked with an "X" above the nameplate.

Replacing the rollers

Only dismantle the injection pump far enough for the roller tappets to be removed. Replace the rollers with new ones and then refit the roller tappets in the same cylinders from which they were taken. This case presents an exception to the rule that only complete roller tappets may be replaced, because here it is only necessary to replace the individual rollers.

The screws for the bearing end plate (Item 46 on the service parts microfiche) and the plugs (Item 81) are to be coated with LOCTITE 582, CVV 82.

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Geschäftsbereich KH Kundendienst. Kfz-Ausrüstung
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Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

K5

Stamp an "F" on the pump top side between the delivery-valve holders for the cylinders 2 and 3.

Service parts

The following service parts are required, order as usual.

Quantity	Part No.	Designation	Item no. on service parts Microfiche
6	1 410 300 013	Roller	–
6	1 410 500 005	Plug	81
2	2 916 710 601	Gasket	58
1	1 410 137 003	Gasket	98
1	1 421 015 047	Gasket	for governor
1	1 411 073 000	Gasket	79
1	1 410 210 018	O-ring	147

Warranty

For those fuel-injection pump assemblies presented before 12.78, submit warranty report as usual. Pumps presented after this date cannot be covered by warranty.

Please report as follows:

Defect no. 05

GA 9

K6

40...46, 58

FUEL-INJECTION PUMP PES..M..
IN MERCEDES-BENZ VEHICLES AND
ENGINES
Leaking at spring-chamber closing cover

VDT-I-403/101 En
1.1986

On the above-quoted fuel-injection pumps there may in individual cases be leaks at the closing cover (Item 111) of the spring chamber.

In the case of complaints about leaking, check the fuel-injection pump for leaks as described in VDT-I-400/109 of 2.1984. If necessary, replace the closing cover with gasket. As an additional measure, lay gaskets of part no. 1 410 121 001 under the fillister-head screws (Item 113) of the closing cover.

As of FD 550, these gaskets are installed as standard equipment. The service-parts lists of the fuel-injection pumps concerned are being extended to include Item 112 - gasket 1 410 121 001.

During the warranty period, claim by warranty report through the usual channels. Outside the warranty period, this work is to be performed subject to payment.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

1	Technical Bulletin

BOSCH

Repair Instructions for the BOSCH Diesel Fuel Injection Pump Type PES..M..

Repair Instructions	
WJP 101/2 B	EP
VDT 11. 1962	

For attention of: Proprietor: Foreman: Mechanic:

I. Introduction

A) Construction of Pump

The PES..M Pump is a Diesel fuel injection pump. It is smaller in dimensions than the PES..A Pump. Its stroke is 7 mm and its plunger diameter is provided for 5...7 mm (Fig. 1).

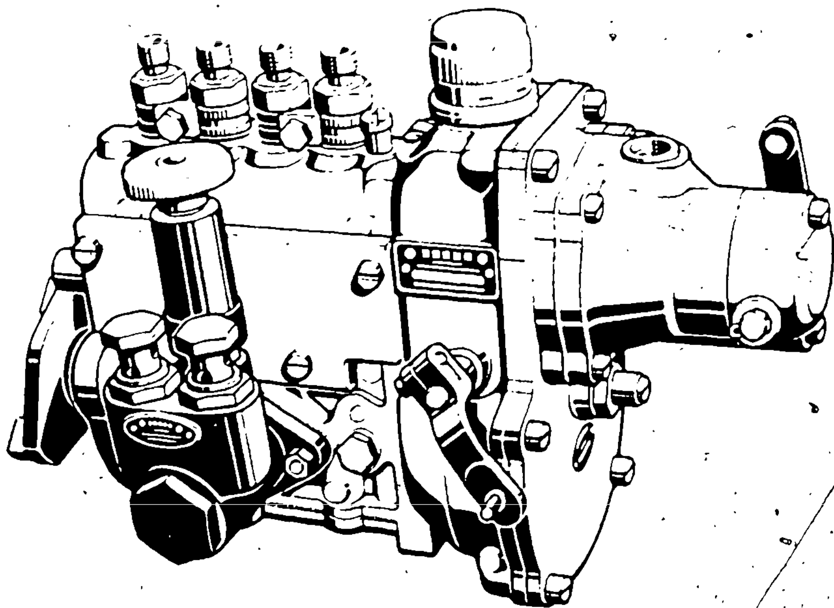

Fig. 1: PES..M Pump with EP/MN 60 M.. Governor

The main difference between this pump and the conventional BOSCH pumps is in the method of transmitting the control rod travel to the pump plungers. Whereas in the conventional fuel injection pump control travel is transmitted to the plungers by rack and toothed segment, in the PES...M Pump adjustable clamping pieces are located on the control rod and these are engaged with levers protruding from the control sleeves of the plungers. (See assembly drawing at the end of this instruction). When the control rod is shifted, the lever on the control sleeve is carried along and transmits the movement to the pump plunger.

The pump is adjusted by displacement of the clamping pieces on the control rod. By this new arrangement the distance between control rod and pump plunger could be considerably reduced as compared to the conventional rack and gear segment type pumps.

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Imprimé en Allemagne

K8

Reduction in constructional height has been attained by:

1. lower control levers instead of higher toothed segments
2. arrangement of the delivery valve entirely inside the connector
3. resting the pump plunger directly on the roller tappet instead of on an adjusting screw in the roller tappet as previously.

The pre-stroke (plunger lift preceding the effective stroke) i. e. the commencement of delivery of the individual elements is adjusted by changing the rollers of the roller tappet. The governor housing is cast on to the pump case (die casting). It can be adapted to accommodate either a pneumatic governor or a centrifugal governor at choice.

B) General

The present instructions will explain only the disassembly and re-assembly of the PES...M standard type pump as these procedures and sequences of operation differ from those of the conventional types.

As regards initial examination and repair procedure Repair Instructions WJP 101/1 B for Diesel Injection Pumps will apply in general.

The injection pump housing and parts should be cleaned in gasoline, kerosene, fuel oil or test oil (Ol 61 v 11) only. If it should happen that trichlorethylene is used, then the parts should be thoroughly washed afterwards in one of the above liquids.

In order to avoid interchanging parts of the individual elements and to have a clear picture of all parts while working on a pump, we recommend the use of a subdivided tray for storing the disassembled parts. (See Fig. WJP 101/1 B, introduction)

II. Initial Examination

See, WJP 101/1 B Section II.

II. Disassembling

The numerals in brackets denote the corresponding code numbers in the folded drawing at the end of this instruction.

1. Mount pump on clamping support EF 8498, using clamping flange EF 8498/30 for this purpose.
   The clamping flange is provided at the top with a flat surface in order to avoid interfering with the control-rod guide sleeve.

K9

If the clamping flange available in the workshop is of the old type, i. e. without flat top, it can be modified as per following sketch:

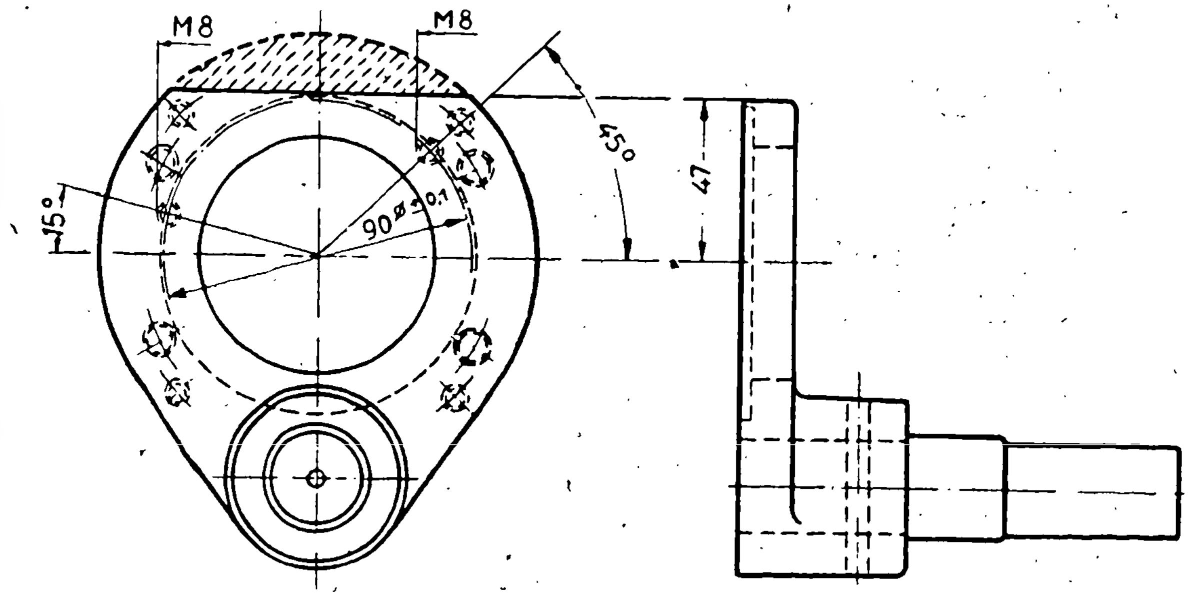


Fig. 2 : Modification of clamping bracket EF 8498/30 for fixing PES..M..-pumps

2. a) Remove the two hexagon nuts (59) together with lock washers (58) and take off fuel supply pump; at the same time collect any lubricating oil flowing out from the camshaft chamber.
   Carefully remove gasket (60) and set aside.

   b) Remove fillister-head screws (55) together with lock washers (56) at cover plate (52) and take off the latter.

   c) Unscrew overflow valve (73) at rear of pump.

   d) Tilt pump into horizontal position and remove bottom cover (65) after having unscrewed countersunk screws (68). Remember to save gasket (67). Bring pump into vertical position again and collect lubricating oil flowing out.

   e) In the case of pumps having a built-on pneumatic governor (EP/MN 60 M..): remove 6 securing bolts and lock washers and slightly pull off cover. Collect any oil emerging.

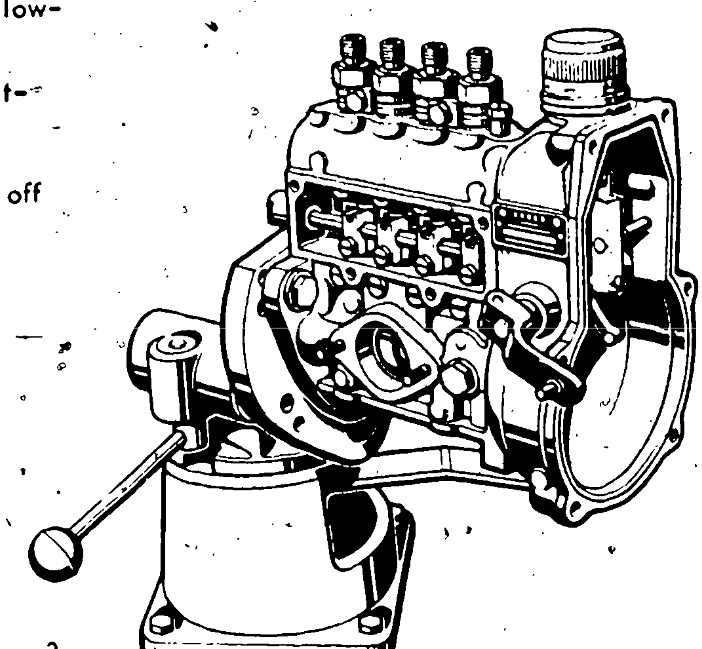


Fig. 3 : Supply Pump and Governor Removed

Remove split pin and washer from pivot pin and finally remove cover with governor. In doing this, watch for the torque control pin and spring and also for the compensating washers of the diaphragm (Fig. 3).

In the case of pumps provided with centrifugal governor (EP/RSV..M..): Remove fixing screws and lock washers and slightly pull off governor cover. Collect any emerging lubricating oil. Uncouple shackle from control rod (spring-supported pin) and starting spring from lug in housing. Finally take off cover. Unscrew round nut on flyweight assembly by using special wrench EFEP 187 A, holding tight coupling at the other end of camshaft with retaining wrench EFEP 119. Take out securing washer and withdraw flyweight assembly by using extractor EF 8449 or EF 8132. Remove Woodruff key from taper of camshaft.

3. At delivery pipe connections (19) loosen screws (23) of the clamping jaws (22) and remove same. Unscrew pipe connectors (delivery valve holders) with socket wrench and detach gasket (18) on connector. Place delivery valve holder and valve spring (16) in a compartment of the already prepared depositing tray.

   Note: All components belonging to one pump element (from tappet to valve holder) should be placed in the same compartment, in order to avoid any confusion. It is advisable to disassemble from left to right, i. e. to commence at cylinder I. This sequence should also be followed during assembly.

   Pull out delivery valve (15) together with gasket (17) and set aside.

4. At control rod (25) remove locating washer (27). Loosen clamping screws (29) on the individual clamping pieces (drivers) (28) and withdraw control rod towards governor end. While pulling out control rod take off the clamping pieces in succession and place into the appropriate compartment of the depositing tray.

5. Temporarily mount drive coupling on taper of camshaft. Rotate camshaft and, in the upper dead-center position of each roller tappet (5) insert tappet holder pin EFEP 308 A in the hole provided (Fig. 4). Remove the 4 securing bolts (47a) of the bearing endplate at pump side I (drive-end), together with lock washers (48).

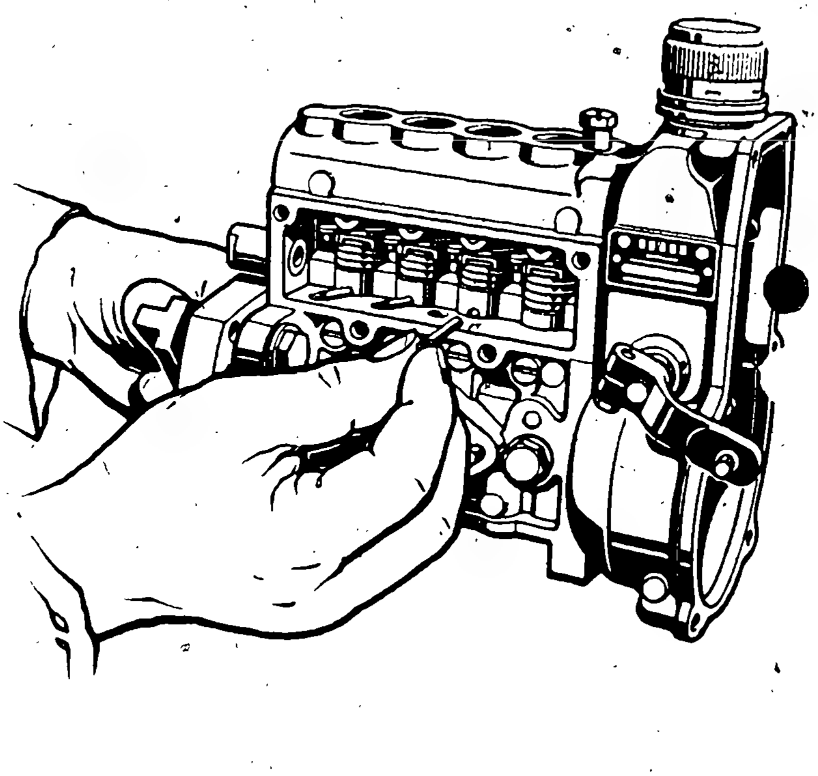


Fig. 4: Introducing the tappet holder pins

K11

By tapping lightly on the camshaft end at pump side 2 (governor end), check whether camshaft and bearing end plate (46a) have become free. If not, remove pump from clamping support and withdraw bearing end plate from camshaft with extractor EF 366 after screwing mounting sleeve EFEP 294 on taper in order to protect the oil seal (41). Now carefully remove camshaft together with ball bearing (40a) and set aside.

6. Again tilt pump into horizontal position. Slacken tappet-locating screws (9) a few turns. By means of wooden stem EFEP 91/4 of tappet forceps EFEP 91, force tappet upwards and simultaneously remove tappet holder pin. Remove tappet by hand and place same into the appropriate compartment of the tray. Take care that the roller pin (6), roller (7) and bearing bush (8) do not get lost or become interchanged with those of other tappets. Pull out pump plunger (14) along with bottom spring support (10) by hand and set aside.

7. Remove plunger spring (11) and upper spring seat (12) by pushing downwards. To do this, press plunger spring from underneath against spring seat and press the latter against the spring by using mounting lever EFEP 307. Now spring and seat together are expelled through the tappet guide by pushing downwards gently and without force (Fig. 5). By doing this, tilting of the spring seat in the tappet guide and damage to latter is avoided.

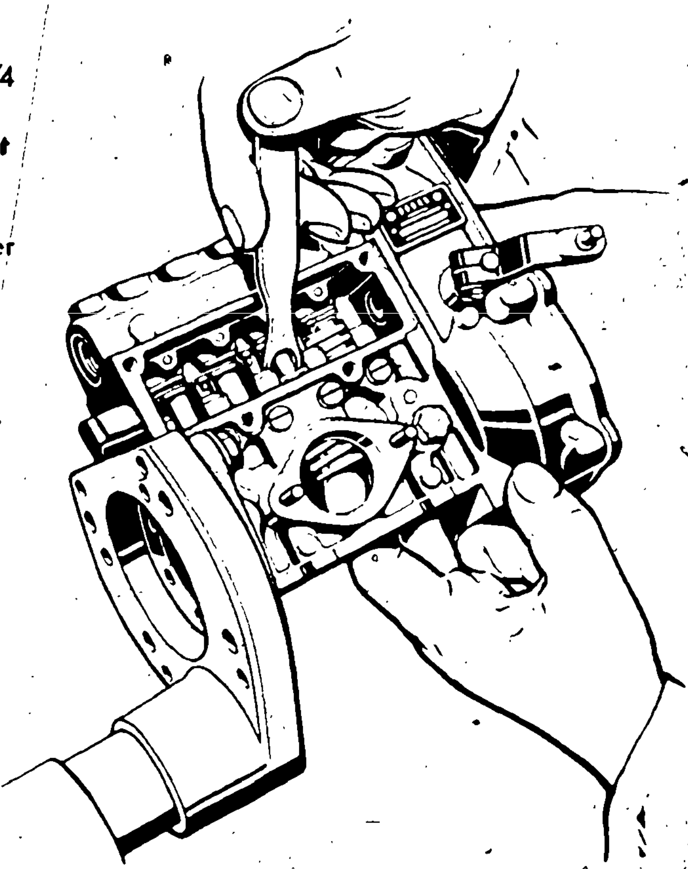


Fig. 5 Removing the upper spring seat by using mounting lever EFEP 307

8. Remove control sleeve (13) and carefully expel pump barrel (14) by pushing upwards.

9. If necessary, remove bearing end plate (46b) at pump side 2. To do this, remove the 4 securing bolts (47b) together with lock washers (48) and carefully force the cover outwards from the inside.
If the outer ring of ball bearing (40b) has to be removed, it should be withdrawn by means of a conventional bearing extractor or extracting collet EF 3108 in conjunction with puller bell EF 3043.

IV. Repair and Replacement

See WJP 101/1 B, Section IV.

V. Reassembling the Pump

A) Assembly Numbers

See WJP 101/1 B, Section V, A).

B) Sequence of Operations during Assembly

All components, even new ones should be thoroughly washed. Immerse all moving parts in test oil Ol 61 v 11 prior to assembly. New elements and valves should be previously freed from protective grease with gasoline and then immersed in test oil.

1. Fix pump housing on clamping support in vertical position. Take pump barrel (14) from depositing tray, clean the sealing face and introduce barrel into the housing in such a way that the vertical groove for the locating pin is in the proper position. Pump barrel must not jam in pump housing and must not be pressed by locating pin. To check, slightly lift from below with a finger and allow to drop freely onto its seating.

2. Check gasket (18) on delivery valve holder (19) to see whether it is satisfactory. Place valve spring (16) in valve holder and install delivery valve (15) with gasket (17). The sealing face of the valve must also be absolutely clean. Then screw the whole unit into the pump housing. The delivery valve holder should be tightened twice at a torque of 5 kpm (36 ft lb) each time and slackened again after each tightening; finally tighten same with a torque of 4 kpm (29 ft lb).

3. Place pump plunger (14) on plunger pliers EFEP 76. Immerse plunger in test oil and check whether it slides easily in the barrels. Leave plunger in barrel and insert holding plate EFEP 309 so that plunger cannot drop out (Fig. 6). Close bore for overflow valve with dummy plug. Remove pump housing from clamping support. Connect air hose to fuel inlet connection (thread M 14 x 1.5) and immerse the pump in test oil. Allow compressed air at 0.5 atm. (7 psi gauge) pressure to flow-in. If an air bubble rises only now and then, the pump is considered tight.

Place pump on clamping support again, remove holding plates, pull out plungers and put them aside in the correct sequence.

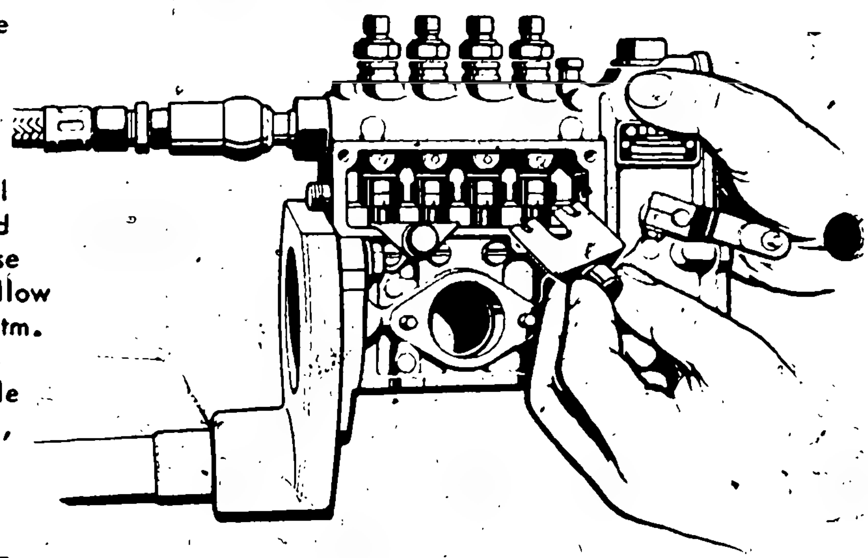


Fig. 6: The holding plates EFEP 309 are used for the tightness test

K13

4. Tilt pump horizontally. Insert control sleeve (13) from the front into the tappet guide (Fig. 7) and push upwards over the shank of the pump barrel.

5. Place spring seat on plunger spring (11) (possibly keeping spring seat in position with some grease) and push both together, upwards from below, into the tappet guide. If nevertheless the spring seat shows the tendency to tilt, hold same straight by means of the mounting lever EFEP 307, as during disassembling. See to it that the spring seat is guided in such a way that its small lug engages behind in the recess in the housing; the ground face of the spring seat then lies exactly toward the front (Fig. 8).

6. Tilt pump into upside down position. Turn control sleeve (13) so that its lever points forwards. Now place bottom spring support (10) on pump plunger (14) and immerse plunger once more in test oil. Carefully introduce plunger into barrel by hand so that the edge does not become damaged. The vane of the pump plunger must be introduced into the control sleeve in such a way that the marking on the vane points forwards, that is in the direction of the control sleeve lever (Fig. 9 illustrates this in the disassembled condition for the sake of clarity). By carefully pressing on the plunger, check whether the plunger lug engages properly in the control sleeve.

7. Introduce tappet (5) into tappet guide by hand and force upwards by using special tool EFEP 91/4. The longitudinal groove in the tappet (tappet fixing) must point forwards (Fig. 10). Press on the tappet until it is in the upper dead center, then, from the front introduce the tappet holder pin into the fixing hole in the tappet visible in the upper part of the pump housing.

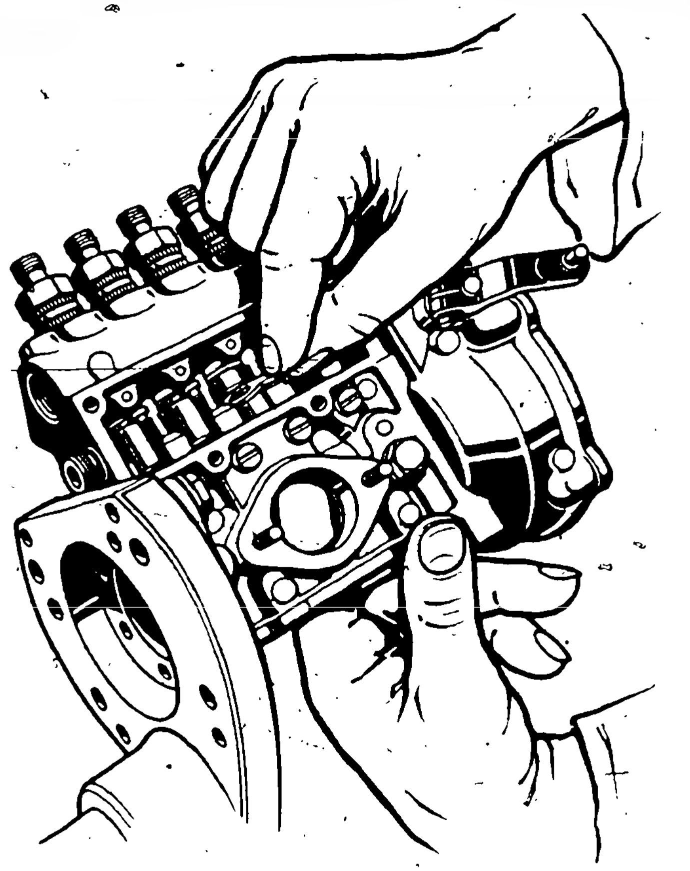


Fig. 7: Introducing control sleeve

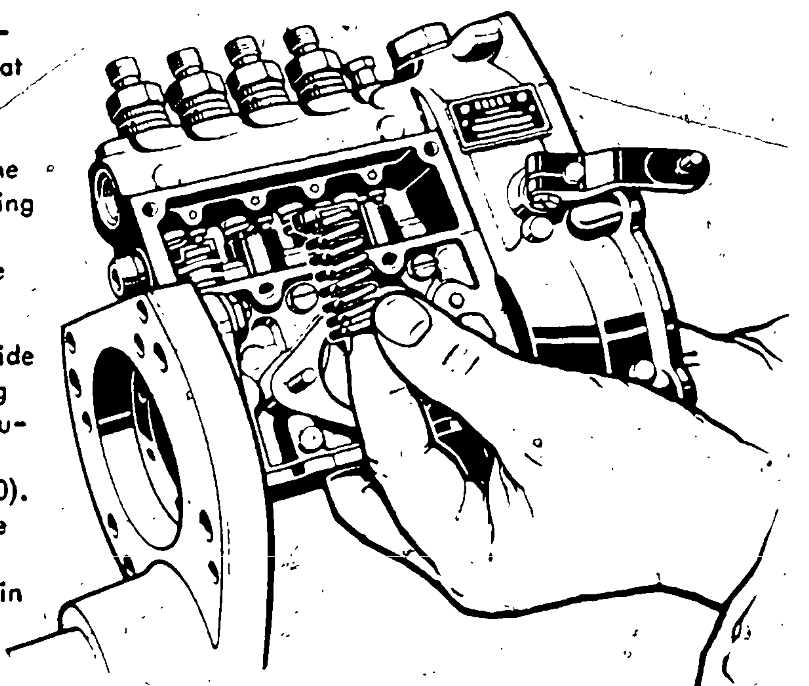


Fig. 8: Fitting upper spring seat

K14

Screw in tappet locating screw (9) at front side of housing. Check lever of control sleeve for free movement to both sides, also check control sleeve for a noticeable vertical clearance.

8. If the bearing endplate (46b) at governor end has been removed, re-fit same without using sealing medium. Introduce camshaft together with bearing endplate and firmly secure the latter with all four bolts. Push measuring tool EFEP 281 tight on taper of camshaft and measure camshaft projection (distance between flange of pump housing and inner face of EFEP 281). This distance must be 9.5 ± 0.5 mm (See also WJP 101/1 B, chapter V B 5.)

Next step is to measure the longitudinal camshaft play. For this purpose screw the axial-clearance measuring device EFEP 225 with dial gauge EFAW 7 onto the taper of the camshaft (while the device is being screwed on and off secure camshaft against rotating by means of a piece of wood or Resitex). Then pull camshaft outwards and set dial gauge to "0". Now press camshaft inwards and read value on dial gauge. The specified axial clearance amounts to 0.03...0.13 mm. If this value is not obtained, the inner race of the ball bearing at governor end should be withdrawn by using extractor EF 3645 and shims (44) added or removed as required. After having properly adjusted projection and play of camshaft, install coupling and remove tappet-holder pins.

9. Adjusting pre-stroke and checking commencement of delivery. Mount pump on test stand and air-vent.

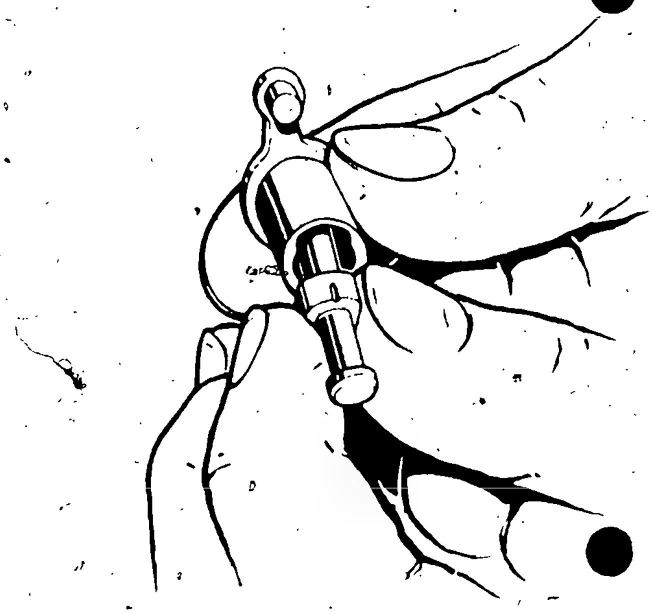


Fig. 9: Proper way of introducing plunger vane into control sleeve (Notch aligned with control lever)

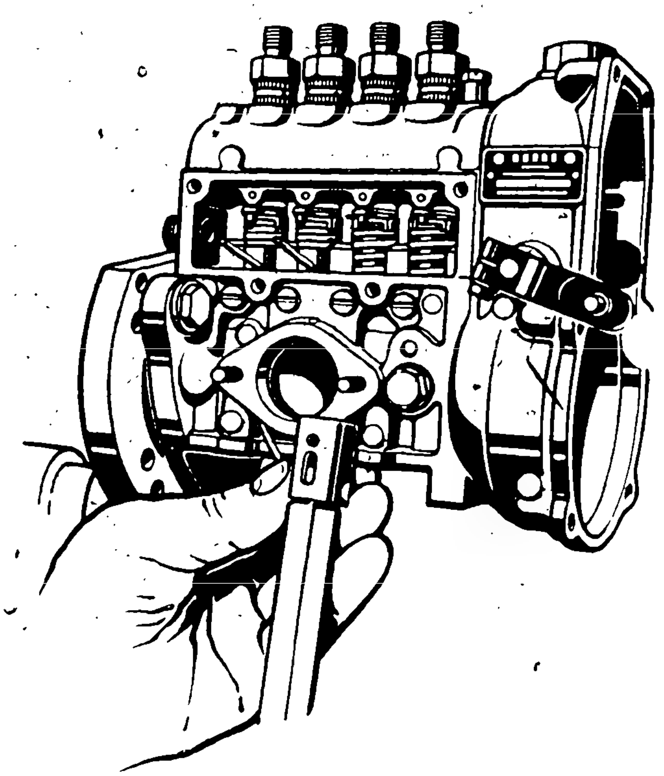


Fig. 10: Installing roller tappet

a) Setting pre-stroke (plunger lift preceding effective stroke).

Turn camshaft of pump in direction of rotation until the element closest to the drive end is in bottom dead center. Mount device EFEP 303 with dial gauge EFAW 7 for measuring commencement of delivery and bring feeler into engagement with the tappet of the above-mentioned element. Set dial gauge to 0 (Fig. 11).

To make it more comprehensive, the following procedures 9a, 9b, and 10 are described individually and in detail. However, after some practice the following steps can be accomplished in one working procedure.

Turn pump further in direction of rotation until the pointer of the dial gauge indicates the amount of pre-stroke as given in the test specification sheet.

Set pointer on graduated disk of test stand to a figure favorable for further measurement. (This is required for testing angular cam displacement according to chapter 10.)

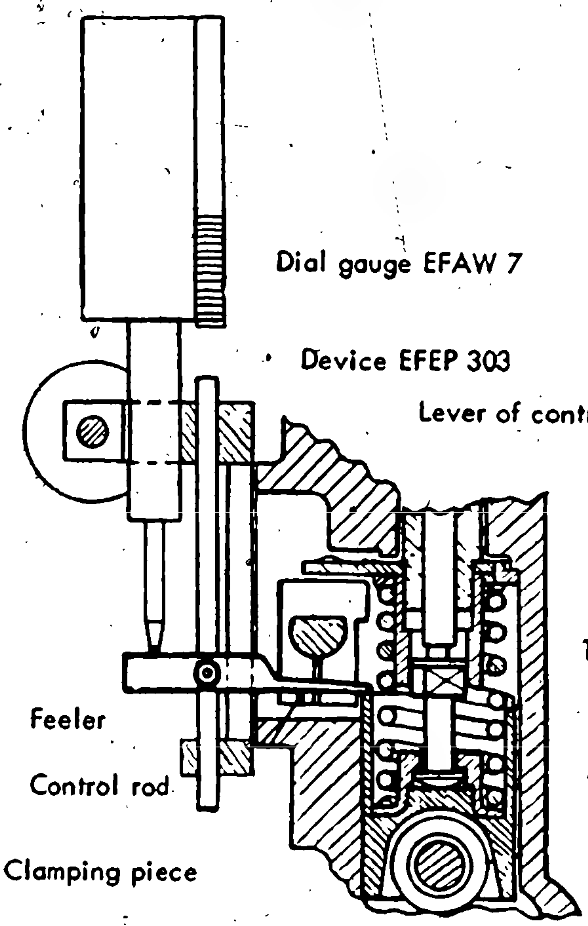


Fig. 11 Measuring pre-stroke with device EFEP 303 and dial gauge EFAW 7 (schematic)

b) Checking commencement of delivery.

Open venting screw on appropriate nozzle holder. Set lever on test stand to "Commencement of delivery".

The plunger lying closest to the drive end is set by hand to bottom dead center. Run test stand without engaging the pump so that oil overflows at the nozzle holder. Only when absolutely necessary, close cock on supply tank. Set lever of control sleeve into straight center position. Turn pump camshaft by hand in the specified direction of rotation until the test oil just ceases to flow at the nozzle holder. Pointer at the graduated disk must again indicate the value determined with the dial gauge.

If this test does not give the same value, the roller of the roller tappet must be changed. It is advisable to note any existing deviation in pencil on the pump housing and to test the cam displacement immediately afterwards. This will once save the procedure of removing the camshaft and the roller tappet.

K16

10. Testing angular displacement of cams

After the testing or adjustment of the element lying closest to the drive end turn camshaft further and, in accordance with the cam sequence (in the basic type 1-3-4-2) test the commencement of delivery of the other three elements one by one.

Displacement is 90° ± 0.5°. Prior to testing each element, open the appropriate overflow pipe at the nozzle holder and close again after the test.

Any deviations from the specified value should be noted in pencil on the pump housing near the particular element (e. g. +2° or - 1°). If the element lying closest to the drive end has also to be adjusted, this value must be taken into account.

Take pump from test stand and remove camshaft as well as roller tappets. Depending on the deviation, fit new rollers into the roller tappets. The displacement should be attained as far as possible without tolerance. The choice of 5 rollers is available, with the diameters

15.30 - 15.15 - 15.00 - 14.85 - 14.70 mm

(0,3 mm roller diameter corresponds to 1° displacement.)
Reinstall roller tappet and camshaft, bring pump to test stand and re-check cam displacement. If the displacement is in order, remove camshaft again and coat bearing cover (46a) with sealing compound Kk 68 v 1 at the contact surface. Now finally fit camshaft and bearing cover and tighten securing bolts (47a) well. Remember to fit lock washers (48). Turn camshaft and withdraw tappet holder pins EFEP 308 A in upper dead center position of the particular cam. Check whether gasket (67) at the bottom cover (65) is still satisfactory. If the felt lubricating plate (66) has been renewed, it must be soaked in oil Ol 24 v 1. Now screw on bottom cover with countersunk screws (68).

11. Tilt pump upwards again
Insert control rod (25) from governor side. At each element, allow pin in lever of control sleeve to engage in the groove of the clamping piece (18) and guide control rod through the bore in the clamping pieces (Fig. 12). (Tightening screw of clamping piece points forwards). When all clamping pieces have been attached, mount locating washer (27) on control rod. Take care that guide lever on control rod end also engages in guide pin (70) in the governor housing. By means of the tightening screw (29), now firmly secure each of the clamping pieces in the middle between the corresponding two lines marked on the control rod (Fig. 13). Check whether control rod still runs easily and whether control sleeves have still a slight up and down clearance.

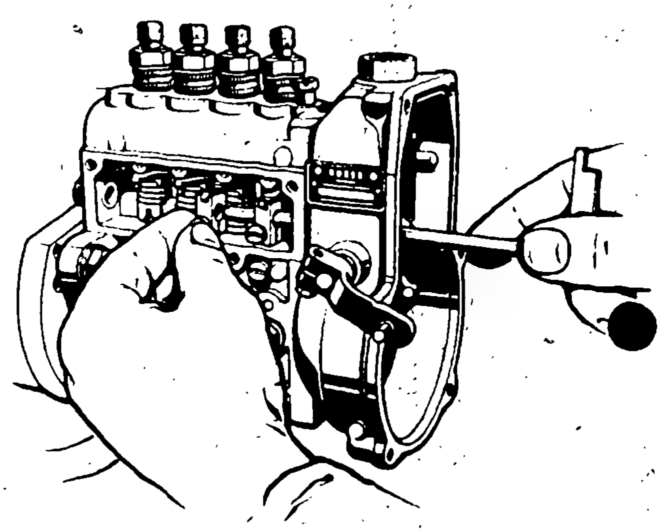


Fig. 12: Attachment of clamping pieces

Check whether clamping pieces are not coming in contact with the upper spring seats (12) or the plunger springs (11). Test whether pin of the control lever in the groove of the clamping member does not come out of engagement in the extreme STOP or FULL position of the control rod. Screw closing cap (72) onto control rod guide sleeve at pump side 1.

12. Test whether gasket (71) for sealing off governor is still satisfactory.

a) Fitting a pneumatic governor (EP/MN 60 M..):
Insert pin of control rod into the hole of the connecting piece of the diaphragm, place washer on pin and secure with split pin. Now press the governor into its groove, taking care that the full load stop rests on the rocker and not below same. Then screw in the 6 securing bolts with their lock washers and tighten well.

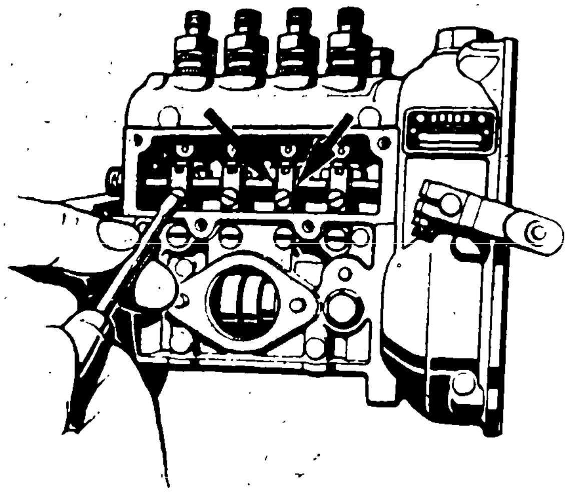


Fig. 13 : Tighten clamping pieces on control rod in such a way that they lie exactly between the two marks.

b) Mounting centrifugal governor (EP/RSV..M..)

Place Woodruff key on taper of camshaft, push flyweight assembly onto taper and place lock washer in position. Screw in round nut with socket wrench EFEP 187 A meanwhile holding coupling at the other end of the camshaft with retaining spanner EFEP 119. Tightening torque 5...6 kpm (36..43 ft lb). The fitting limit amounts to 30 $\pm$ 0.2 mm. Adjusting of fitting limit, see WJP 211/5, Section IV. A) 7.
Hold governor cover close against housing, hook starting spring in lug of housing, insert shackle with pin in control rod of injection pump and secure with leaf spring. Finally mount governor cover on housing and firmly secure with cheese head screws and lock washers.

13. Screw on supply pump with hexagon nuts (59) and lock washers (58); do not forget gasket (60).

14. At rear of pump, screw in overflow valve (73), and also leakage oil overflow (37).

Pour in lubricating oil through bore for air cleaner (69); in pumps with pneumatic governor this should continue until oil just begins to emerge at the oil level control hole (34) at the front of the housing. Then screw in plug with gasket (35).
In pumps with centrifugal governor, check oil level at dip stick of governor.

Screw in air cleaner on governor by hand. The fitted snap spring will secure the air cleaner against coming loose.

K18

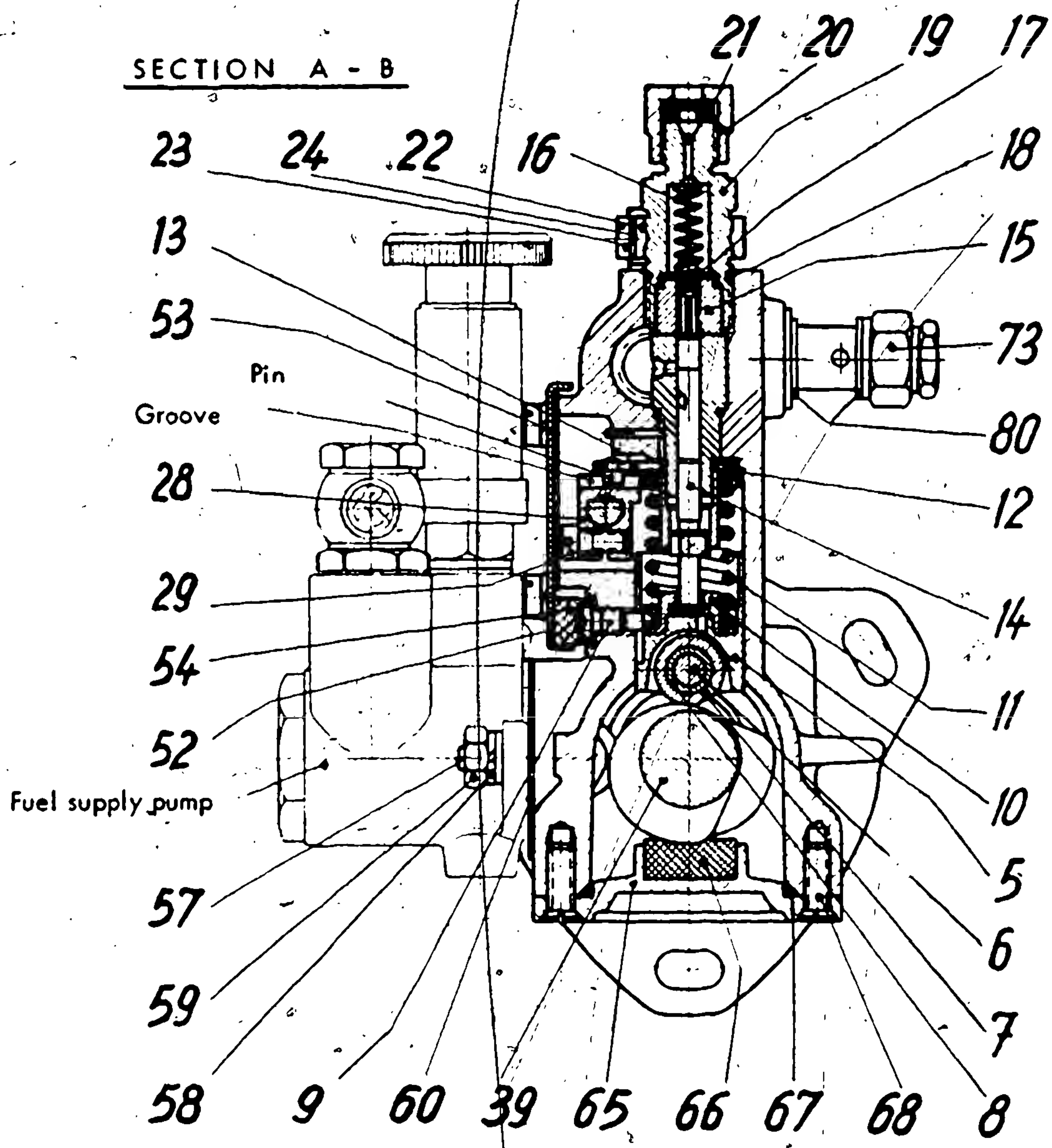
I . Mount cover plate (52) with fillister head screws (55) and lock washers (56). Screw clamping jaws (22) on to pipe connectors at top. Keep to tightening torque of 1.5 kpm (11 ft lb) so that when the retaining nuts are tightened up later, the pipe connectors themselves should not turn.
Remove pump from clamping support and pass on for testing and adjusting.

VI. Special tools and devices

EF 8498	Clamping support	
EF 8498/30	Clamping bracket in conjunction with EF 8498 (possibly modified in accordance with Fig, 2)	
EFEP 119	Retaining wrench	
EFEP 187 A	Socket wrench	
EF 8449	Extractor	only for fitting a centrifugal governor EP/RSV..M..
or EF 8132	Extractor	
EFEP 308 A	Tappet holder	
EF 366	Extractor	
EFEP 294	Mounting sleeve	
EFEP 91/4	Wooden stem (Part of tappet grip EFEP 91)	
EFEP 307	Mounting lever	
EF 3108	Puller collet	Included in set of puller collets or puller bells EF 3116 or EF 3235 respectively
EF 3043	Puller bell	
EFEP 76	Plunger pliers	
EFEP 309	Holding plate	
EFEP 281	Measuring strip	
EFEP 225	Axial clearance measuring device	
EFAW 7	Dial gauge in conjunction with EFEP 225	
EF 3645	Extractor	
EFEP 303	Measuring device for commencement of delivery	

INJECTION PUMP PES 4 M..50..70/320 R 1

SECTION A - B



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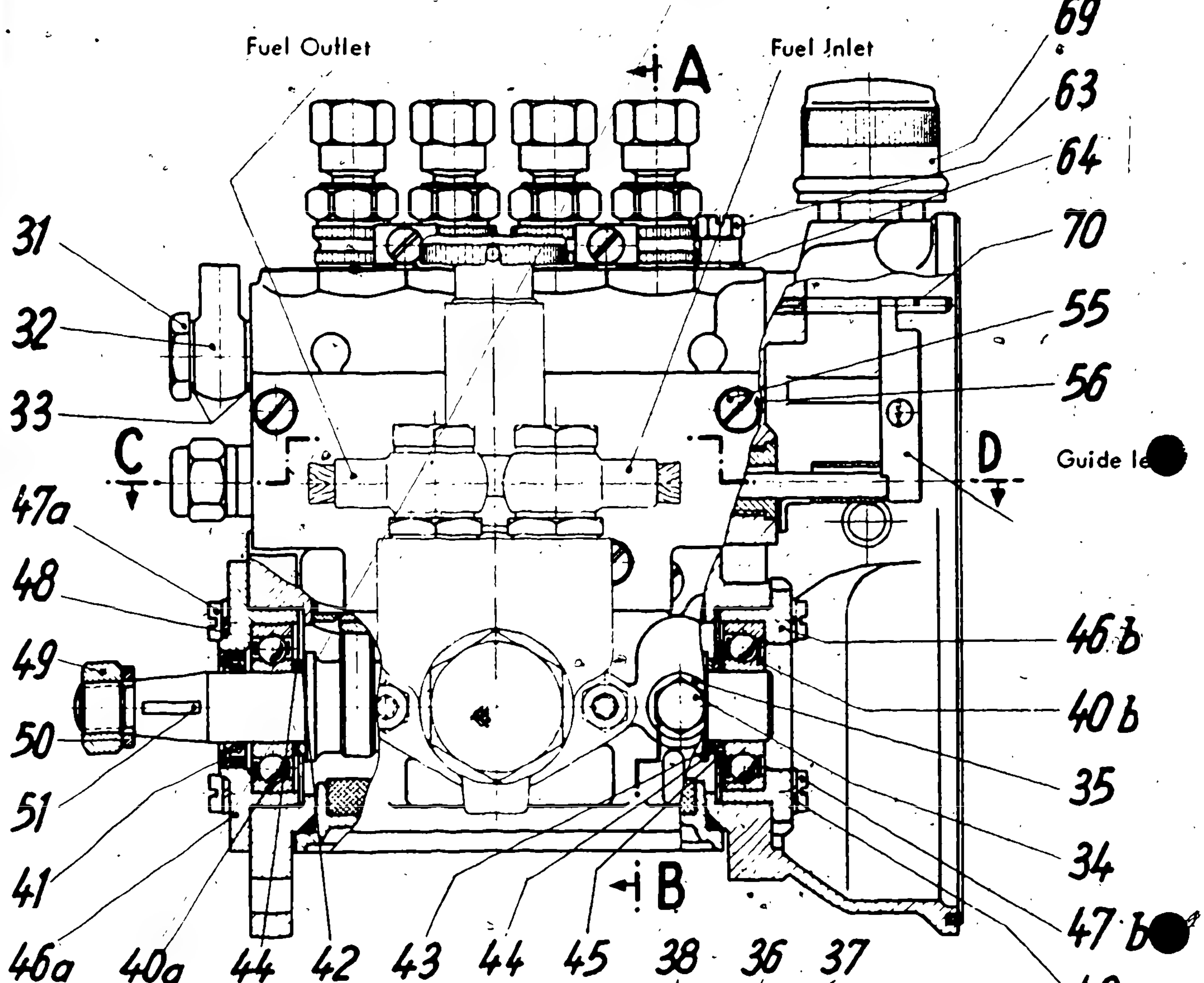
Fuel Outlet
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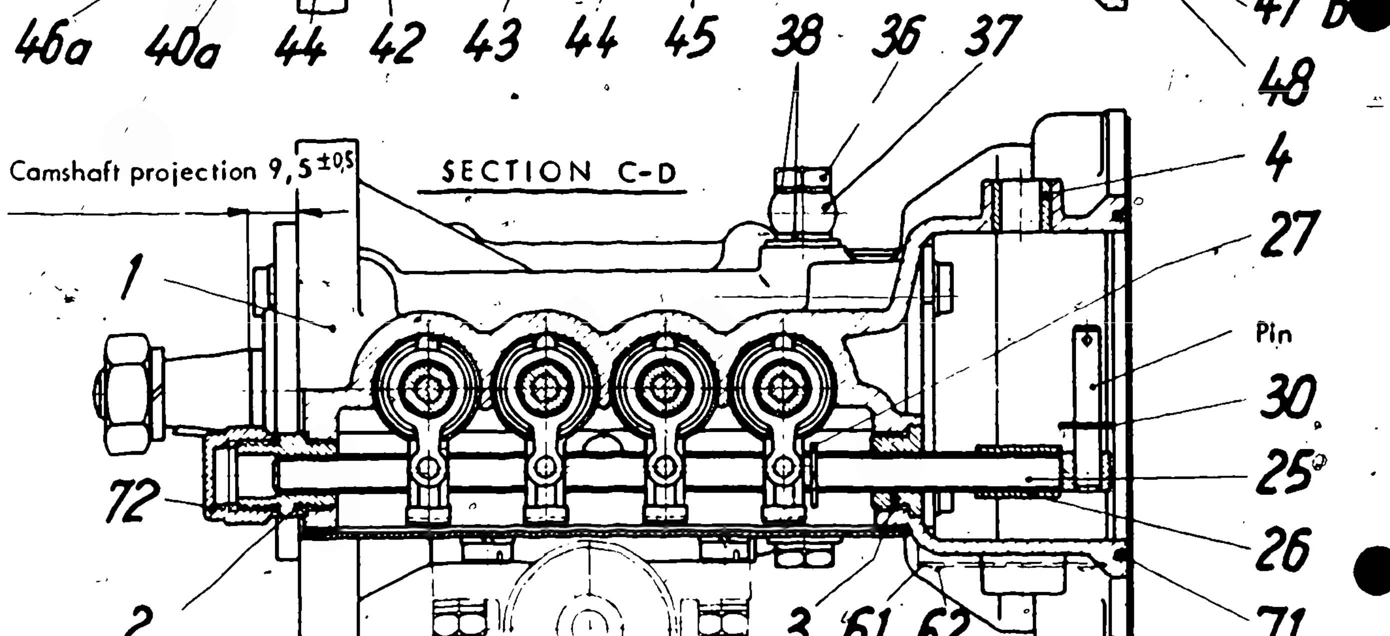
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Camshaft projection 9,5 ±0,5
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SECTION C-D

BOSCH

REPAIR INSTRUCTIONS

40

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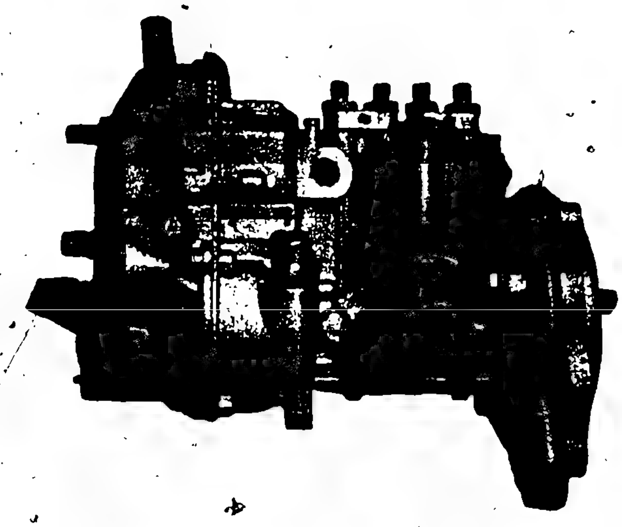


Fuel Injection Pump Type PES 4 M . .

K22

Cross-reference chart

The following list gives the repair tools listed in Repair Instructions VDT-WJP 101/2 B and the corresponding KD designation required for future orders.

EF designation	KD designation or Part No., Remarks
EF 366	To be manufactured locally
EF 3043	KDAW 9995/0/2
EF 3108	KDAW 9995/8
EF 3645	KDAW 9989
EF 8132	KDEP 2918
EF 8449	KDEP 2886
EF 8498	KDEP 2919
EF 8498/30	Prohibited, replaced by KDEP 2963 with EFEP 157/6. Clamping bracket KDEP 1031 is required to clamp pumps with adapter diameter 145 mm
EFEP 76	KDEP 2915
EFEP 91	KDEP 2941
EFEP 91/4	KDEP 2941/2
EFEP 119	KDEP 2906
EFEP 187 A	KDEP 2998
EFEP 225	KDEP 2890
EFEP 294	KDEP 2874
EFEP 308 A	KDEP 2995
EFEP 309	KDEP 2913
EFAW 7	1 687 233 011 } Test tools which are to be ordered by giving the part numbers.
EFEP 303	0 681 440 017 }

Description

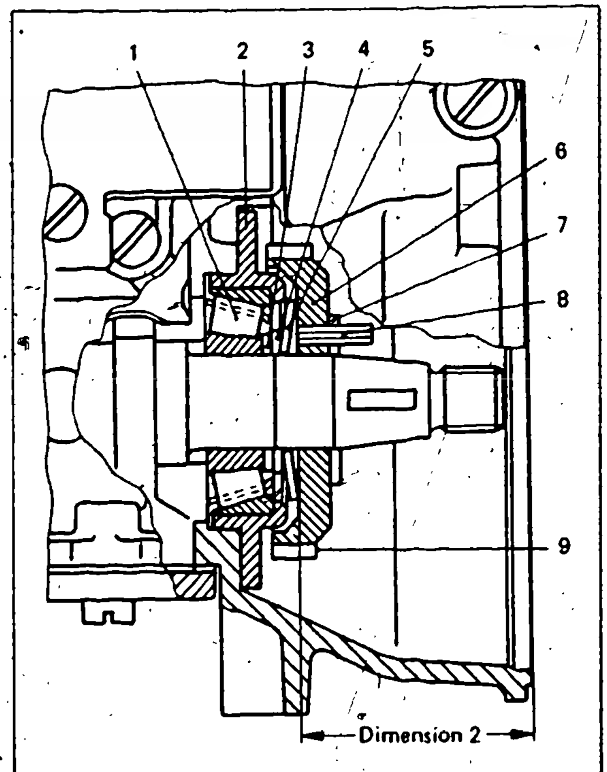
The drive device for a tachometer is installed for the first time in injection pumps PES 4M 70 C 321 RS 52 with EP/RSV.. governor.

This drive device consists of a drive gear and a tachometer drive shaft.

The drive gear (see Fig. 1) is mounted on the governor side of the camshaft end between the cone bearing and the collar of the flyweight assembly. It is connected to the collar with a driving pin. Compensating washers are used for correct adjustment of the gear position. The tachometer drive shaft consists of a helical gear with shaft, a threaded bushing which provides a bearing for the shaft, the thrust washers and a retaining ring. These parts form one unit which is assembled before installation. The entire drive is screwed laterally onto the governor housing in a threaded eye.

The drive device is installed after assembly of the injection pump and before mounting the governor.

Installation and necessary adjustments are described below.



1

1 Cone bearing
2 Bearing flange
3 Spacer ring
4 Compensating washer
5 Conical spring washer
6 Drive gear
7 Compensating washer
8 Driving pin
9 Position of depth gauge when measuring dimension 2

Assembly of drive device

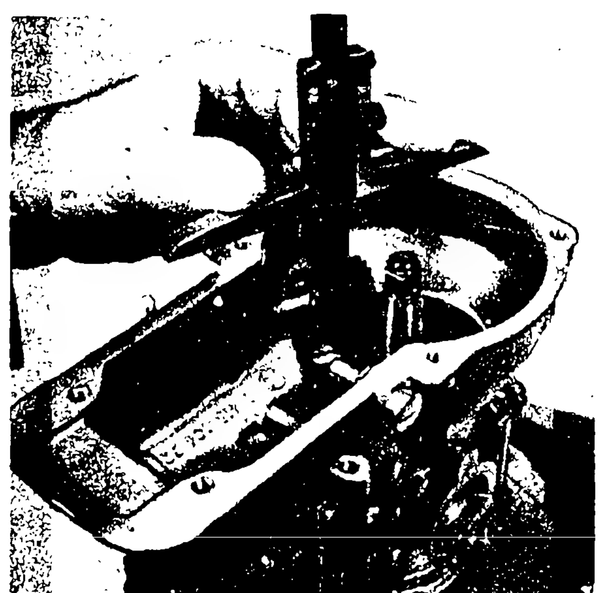
Fit a seal ring onto the tachometer drive shaft and screw into the governor housing.

Clamp the pump to the drive coupling in a vertical position in the vise.

Measure the distance between the helical gear hub and the seating surface of the governor housing cover.

Add one-half of the helical gear hub diameter to the measured dimension.

Note the result **(dimension 1)**.


2

Fit the spacer ring (3), compensating washers (4), conical spring washer (5) and the gear (6).

Note: mounting position of the conical spring washer: indented side toward the gear; mounting position of the gear: groove toward the cone bearing.

It is recommended to use the spacer ring and compensating washers which were fitted before disassembly. If these are no longer at hand, the spacer ring should be 2 mm wide and the compensating washers of any thickness desired.

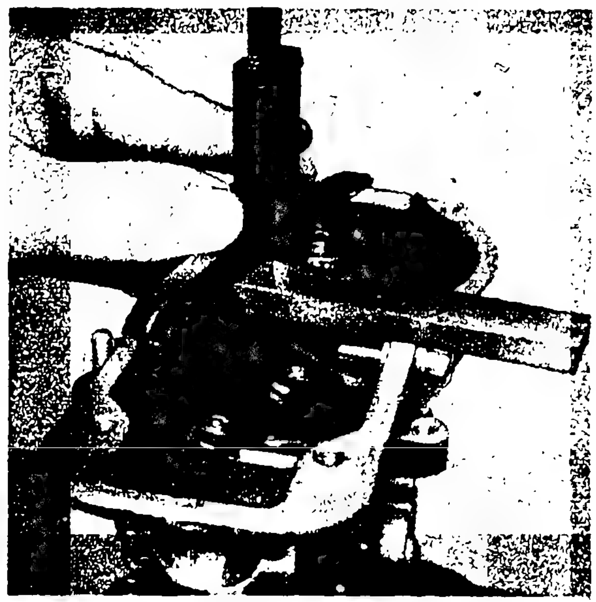
Mount the flyweight assembly.
Screw on the lock nut. Tighten only by hand.

Measure dimension 2 (see Fig. 1):
Rest the depth gauge against a machined rule approx. 8 mm wide (Fig. 3).

Add half the width of the ring gear to the result and subtract the width of the rule.

At this point, dimension 2 must be 0.5 ± 0.1 mm less than dimension 1 (Fig. 2) measured previously.

Adjust by exchanging the compensating washers (4).

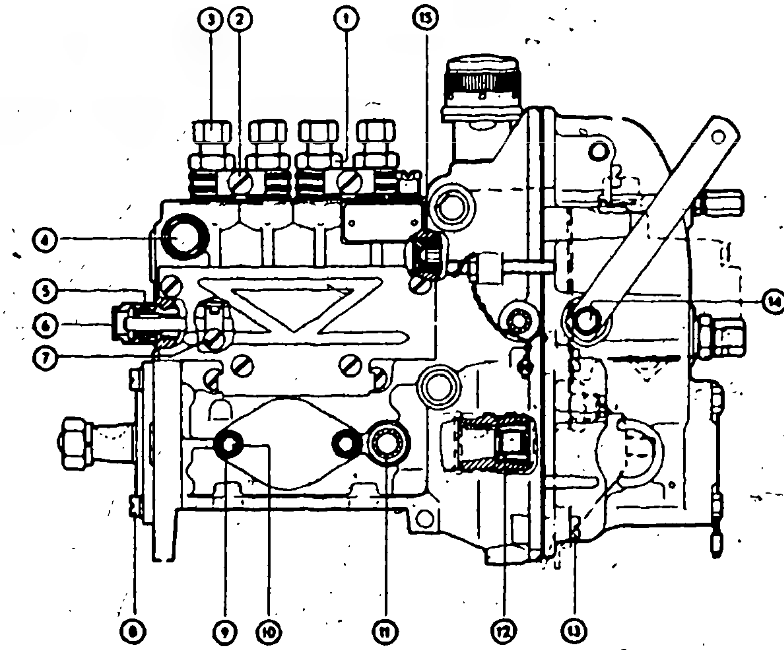

3

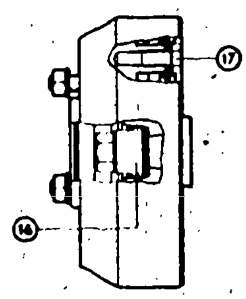
Note: the total width of the compensating washers should not be more than 1 mm. A spacer ring (3) of appropriate width should be fitted if necessary.

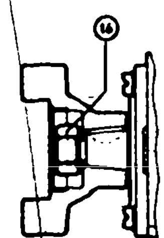
Now tighten the lock nut of the flyweight assembly with the prescribed torque (do not forget the spring lock washer).

Measure dimension 2 once again. The result must now correspond to dimension 1. Adjust by fitting compensating washers of appropriate width.

Mount the governor as usual.







Tightening torques in kgf.m

① Delivery valve holder with distinguishing groove (thread must be rubbed with tallow)	3 - 0 - 3 - 0 - $3^{+0.5}$
② Fillister head screw for clamping jaws	0.5 ... 0.65
③ Screw cap (pressure line connection) Thread M 12 x 1.5	max. 2.5
④ Threaded bushing	2^{+1}
⑤ Control rod guide sleeve	3 ... 4
⑥ Control rod closing cap	1
⑦ Cheese head screw for clamp	0.4 ... 0.5
⑧ Bearing end plate fastening screws	0.7 ... 0.9
⑨ Hexagon nut	0.5 ... 0.7
⑩ Stud	0.3 ... 0.4
⑪ Swadged nipple Thread M 14 x 1.5 Thread M 16 x 1.5	 $2^{+0.5}$ $3^{+0.5}$
⑫ Centrifugal governor	5 ... 6
⑬ Governor cover fastening screws	0.5 ... 0.7

⑭ Control lever fastening screw	0.8 ... 0.9
⑮ Screw plug	$3^{+0.5}$
⑯ Timing device and connector Cone diameter 17 mm, Thread M 12	 6 ... 7
Cone diameter 20 mm, Thread M 14 x 1.5	8.5 ... 10
⑰ Timing device cover (4-spring version) Hexagon screw M 8	2.2 ... 2.4

BOSCH

TEST INSTRUCTIONS

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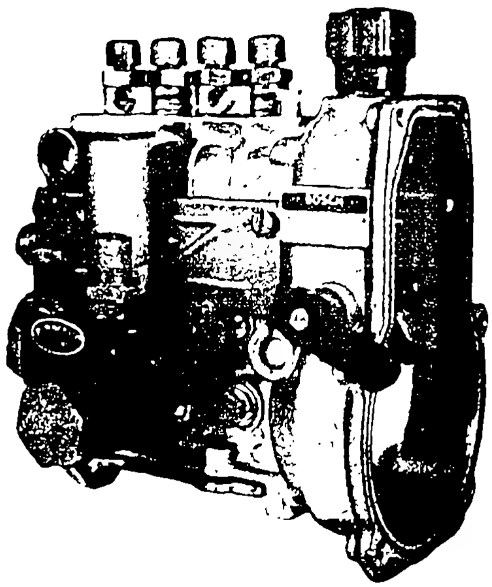
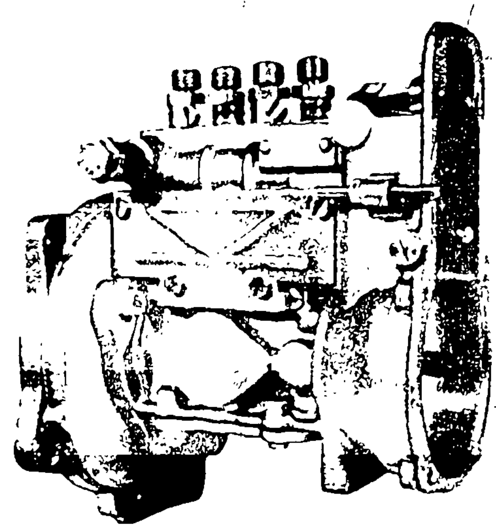




Fuel Injection Pumps 0 400 . .

PES . . M . .

K27

Tools

For fuel injection pumps with pilot diameter	Part Number	Type	Application, Remarks
68 mm	1 688 010 010	EFEP 157	Use clamping bracket in combination with flange 1 685 720 018 to clamp the fuel injection pump onto the test bench at a shaft center height of 125 mm.
68 mm	1 688 010 011	EFEP 157 A	Same as above except for fuel injection pump test benches with shaft center height of 110 mm.
68 mm	1 685 720 018	EFEP 157/6	Flange for clamping the fuel injection pump onto the test bench, in combination with clamping bracket 1 688 010 010 or 1 688 010 011.
68 mm	1 688 130 042	EFEP 476	Measuring instrument for measuring control rod travel, in combination with dial indicator 1 687 233 015.
145 mm	1 688 010 101	EFEP 638	Clamping bracket for clamping the fuel injection pump onto test benches with shaft center height of 110 mm; in combination with intermediate plate 1 682 310 026 on test benches with shaft center height of 125 mm.
145 mm	1 682 310 026	EFEP 29A/1	Intermediate plate used in combination with clamping bracket 1 688 010 101.
145 mm	1 688 130 095	EFEP 565	Measuring instrument for measuring the control rod travel, in combination with measuring instrument 1 688 130 042.
68 and 145 mm	0 681 440 017	EFEP 303	Measuring instrument for measuring plunger lift to port closing, in combination with dial indicator 1 687 233 001.
68 and 145 mm	1 687 233 011	EFAW 7	Dial indicator, 10 mm measuring range; 1/100 mm divisions (with return spring).
68 and 145 mm	1 687 233 015	EFAW 144	Dial indicator, 30 mm measuring range; 1/10 mm divisions (without return spring).
	1 416 430 012	ZKH 74Z9X	Coupling for conical shaft end, 17 mm diameter.
	1 416 430 017	ZKH 74Z18X	Coupling for conical shaft end, 20 mm diameter.

Test equipment, cf. VDT-WPP 110/2 B

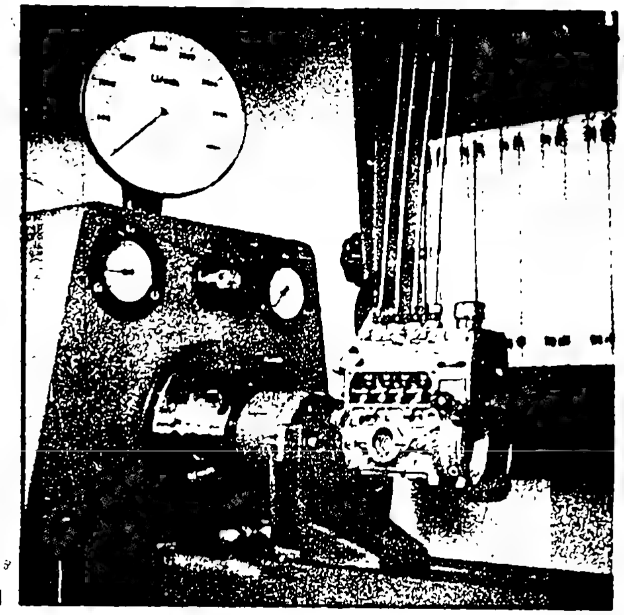
Clamping the pump

Clamp the pump, without governor, onto the test bench using the clamping bracket and flange (pilot diameter, 68 mm), or clamping bracket (pilot diameter, 145 mm), and connect up.

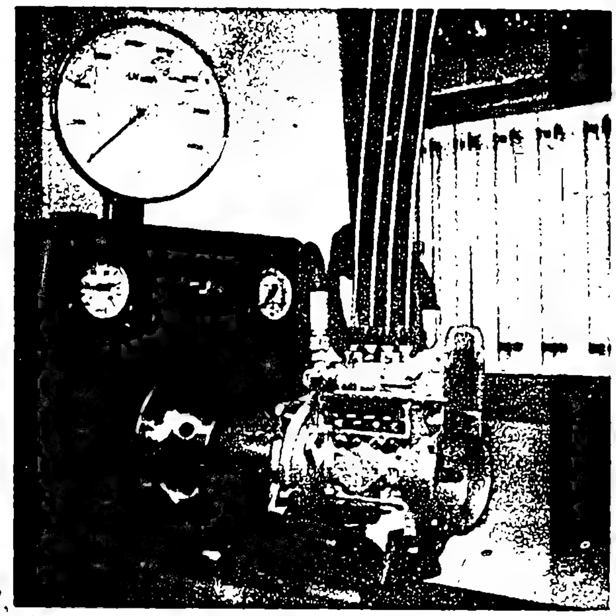
Unscrew the supply pump and fit the cover plate (e.g. 1900 508 024).

In order to conduct the port closing test and also, as a rule, in order to test and adjust the fuel delivery, the overflow valve should be unscrewed. Seal the tap hole using a drain plug with collar and hexagonal socket M 14 x 1.5 DIN 408 and an appropriate seal ring.

For **exceptional cases**, the correct overflow valve to be used is indicated in the Test Specification Sheet.



1



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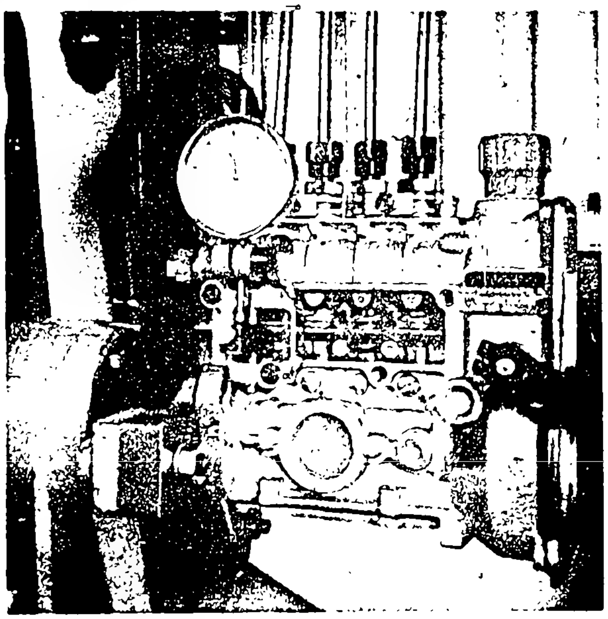

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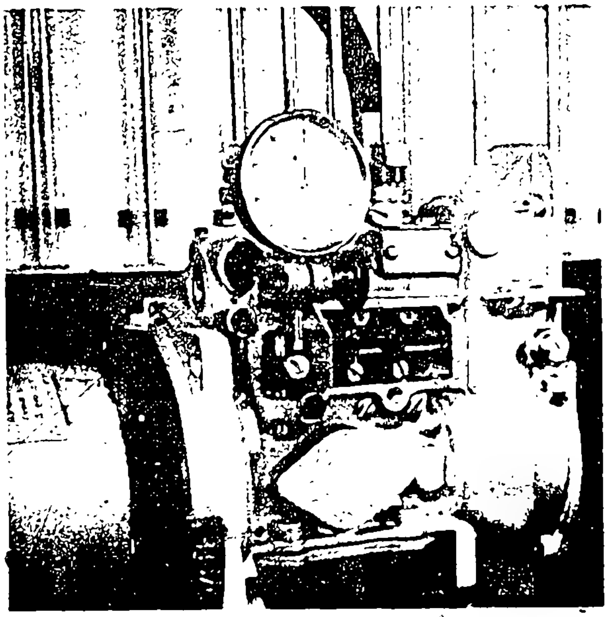


4

Testing port closing and adjusting plunger lift to port closing

Port closing has been reached when the flow of oil at the test nozzle holder overflow pipe reduces to a drip.

Plunger lift to port closing is the plunger travel in mm between plunger BDC and port closing.

Increase the test oil intake pressure until the test oil, with open bleeder screw on outlet 1 test nozzle holder, begins to flow from the overflow pipe in a stream without air bubbles.

Note:
If fuel intake or return is on the spring chamber cover side of the pump, the measuring pipe used to measure the plunger lift to port closing must be modified according to drawing 2, page 7.

With outlet 1 tappet in the BDC position, screw the measuring device onto the pump. Ensure that the measuring device feeler is seated correctly on the rim of the tappet sleeve and that it does not rub against the plunger spring.

With the plunger at BDC, set the dial indicator to "0". Adjust the control rod for maximum travel.

The control rod position for special cases is given in the appropriate Test Specification Sheet.
Turn the pump cam shaft slowly in the correct direction of rotation until port closing occurs.
Read the dial indicator and compare this value with the data given in the Test Specification Sheet. When checking, the tolerances specified can be exceeded by 0.05 mm.
Make note of any deviations.

With the measuring device fitted, do not turn the cam shaft past that point at which port closing was reached (dial indicator feeler will be bent).

With outlet 1 plunger at prescribed "plunger lift to port closing" position set the graduated disc pointer to a convenient multiple of 10 on the disc.

Remove the measuring device for measuring the plunger lift to port closing.

Close the bleeder screw (outlet 1).

Open the bleeder screw on the test nozzle holder of the outlet which follows in the cam order. Turn the cam shaft until port closing occurs. On pumps with four outlets, this should occur after 90 ± 0.5°.

Make note of any deviations.

Proceed in the same manner for the remaining outlets.

Differences (deviations) are compensated for by using the appropriate tappet rollers.

Testing and adjusting fuel delivery

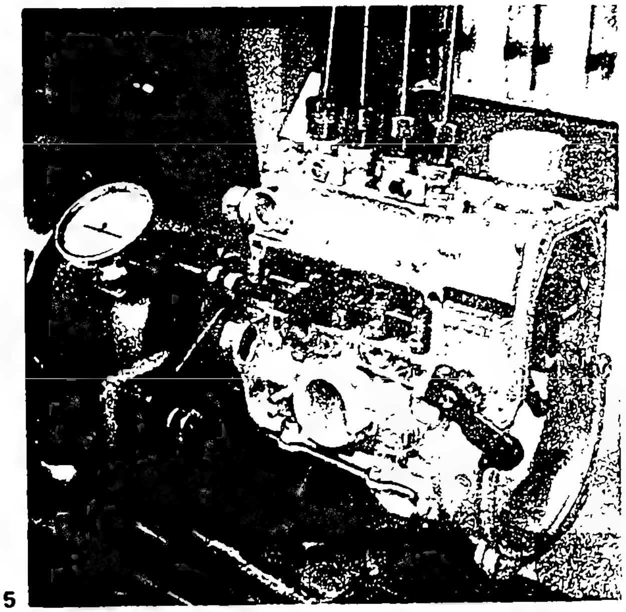
Fill the cam shaft chamber with lubricating oil.

Determine whether or not setting with overflow valve is prescribed (cf. Note in Section "Clamping the pump").

Fit the measuring device with dial indicator for measuring the control rod travel. For pumps with pilot diameter of 145 mm, the measuring device must be modified according to Drawing 3, page 7, and an additional bolt must be made.

Mounting of the measuring device is shown in Drawing 1, page 6.

Test oil intake pressure, cf. VDT-WPP 110/2 B.



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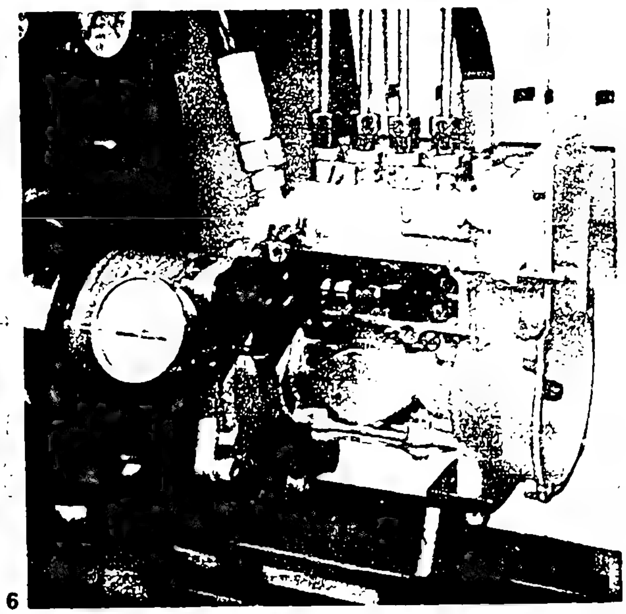
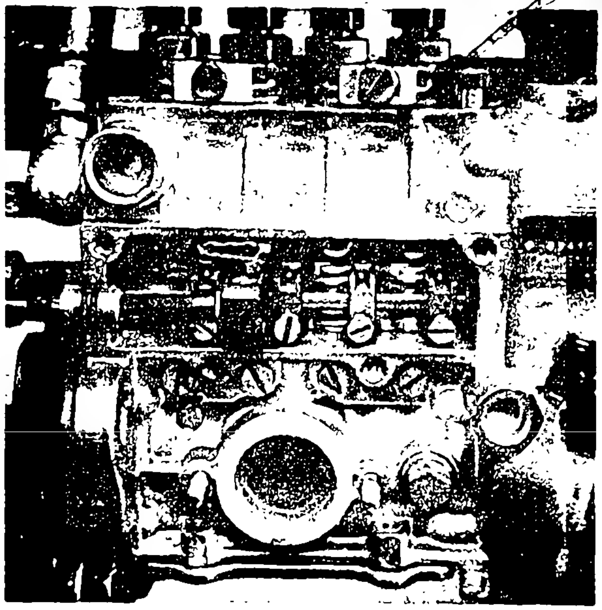


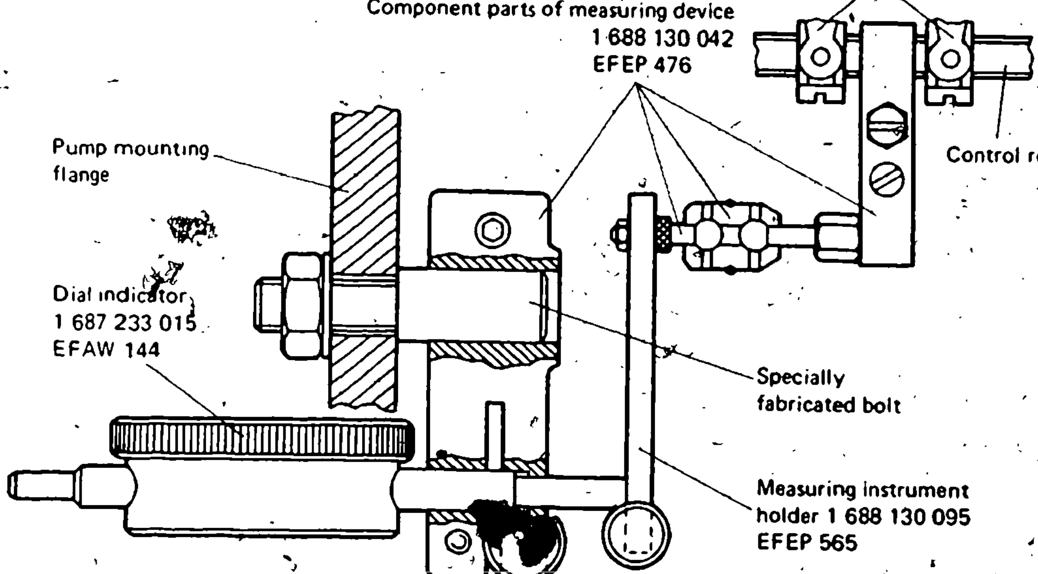
6



7

Drive the pump at the speed given in the frame under Section "A" of the Test Specification Sheet, adjust to the prescribed control rod travel, test the quantity of fuel injected and adjust to the nominal value by shifting the clamping pieces.

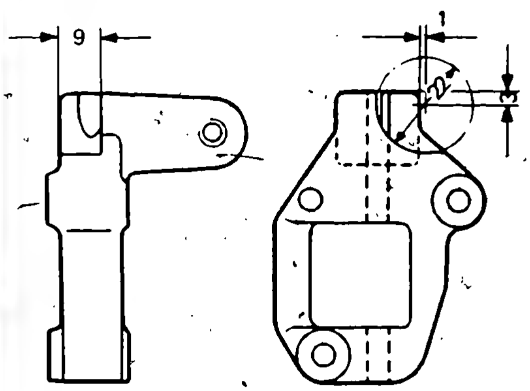
The clamping pieces must be located between the appropriate markings on the control rod.



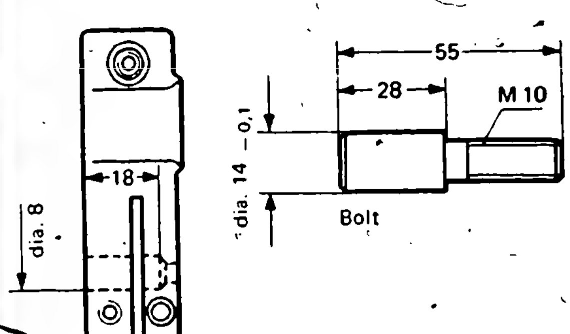
Drawing 1

Measuring device mounting
for measuring control rod travel
(pilot diamter 145 mm)

L4



Drawing 2 Measuring device holder EFEP 303



Drawing 3 Measuring device holder EFEP 476

L5

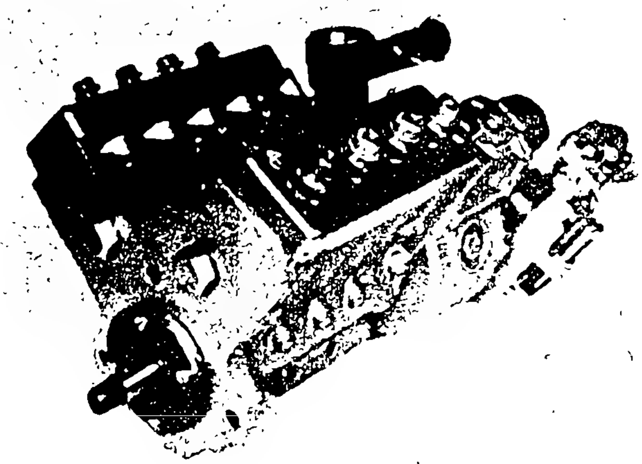
BOSCH

VDT – WPP 115/1 B 1st supplement **EP**
Edition 8.69
Translation of German edition of 11.68

TEST INSTRUCTIONS

Diesel Injection Pumps

PESV .. P .. 041 ..



CONTENTS

ROBERT BOSCH GMBH STUTTGART GERMANY

L6

1. TEST EQUIPMENT

	Part No.	Type No.
Nozzle holder assembly (175 + 5 kp/cm^2)(2500 + 70psi)		
plunger and barrel diameters up to 10 mm	0 681 343 009	EF 8511/9A
plunger and barrel diameters from 10.5 mm upwards	0 681 443 022	EFEP 215 C
Fuel injection tubing, straight (6 x 1.5 x 600)		
plunger and barrel diameters up to 10 mm	1 680 750 015	EFEP 198/7
plunger and barrel diameters from 10.5 mm upwards	1 680 750 026	EFEP 198/15
Mounting bracket for 125 mm (4.92 in.) shaft center height		
Bore diameter 86 mm	1 688 010 040	EFEP 586
Bore diameter 95 mm	1 688 010 042	EFEP 586 A
Bore diameter 105 mm	1 688 010 044	EFEP 586 B
Support block	1 638 030 047	EFEP 587
Measuring device: Plunger lift to port closure	1 688 130 085	EFEP 388A
Dial indicator for above	1 687 233 011	EFAW 7
Control rack travel measuring device	1 688 130 030	EFEP 393
Special accessories, see AHF..		
Dial indicator for above	1 687 233 015	EFAW 144
Setting device for centrifugal governor	0 681 440 006	EFEP 56C
Clamping device (supplementing setting device EFEP 56 C) for testing RQ(U)V and EP/RS(U)V	1 688 040 122	EFEP 56 C/4
Overflow valve (if none on pump)	1 417 413 025	EPVE 176 P 2 Z
Installing device (for installing O-ring)	1 688 110 028	EFEP 387
Ring wrench, open-end (21 x 24 serrations)	1 687 950 525	EFEP 386
Extractor for plunger and barrel assembly	1 688 110 026	EFEP 391
Contact pulse transmitter for injection timing device	1 687 224 515	EFEP 581
Contact stroboscope (pistol form)	0 681 101 104	EFAW 164

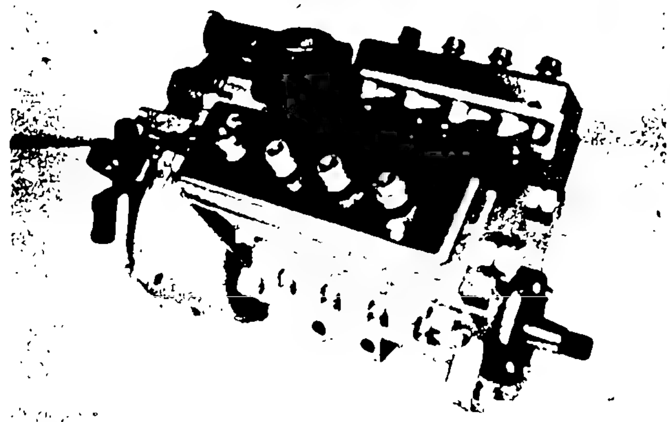
L7

N6 L7
M6

The test instructions VDT-WPP 115/1B also apply to the PESV-P pump. This supplement presents all procedures in concise format, except for any work deviating from that applicable to in-line pumps which is described in detail.

2. TEST CONDITIONS

Introduction: The PESV..P pump is a double row V-type pump featuring lower height and shorter overall length.

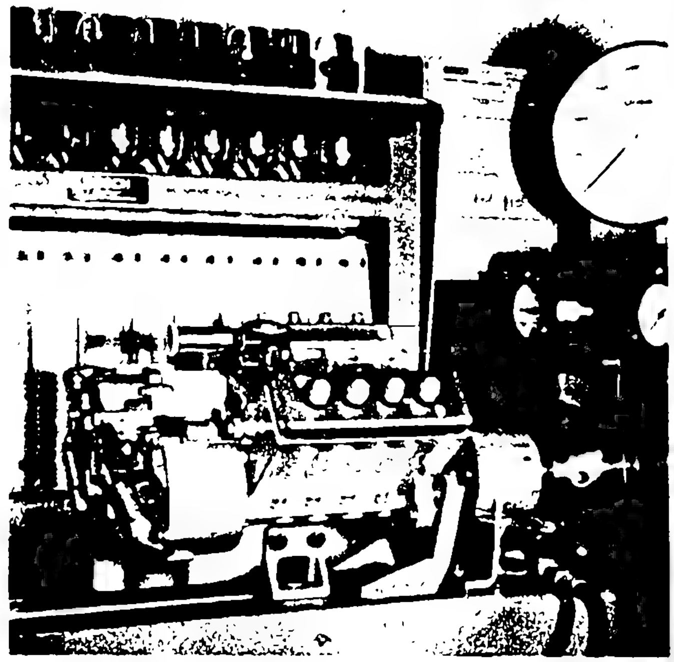


1

The housing has a V-angle of 75°. The supply pump is located within the V and operated by a special roller tappet.

The control racks of the L.H. and R.H. barrel/plunger rows are interconnected by a double lever with sliding mounting on a baseplate. For "L.H." or "R.H." determination of barrel/plunger assemblies, look on to the drive end : When looking on to the drive end, the barrel/plunger assembly 1 is the first assembly in the R.H. row, followed by assemblies 2...4 ; the barrel/plunger assembly 5 is the first assembly in the L.H. row, followed by assemblies 6...8 (see also VDT-WJP 115/1 B).

Due to the compact construction, the roller tappets and camshaft had to be modified as compared with the in-line pump. The governor is mounted at an angle along the R.H. row of plunger/barrel assemblies (Fig. 1).

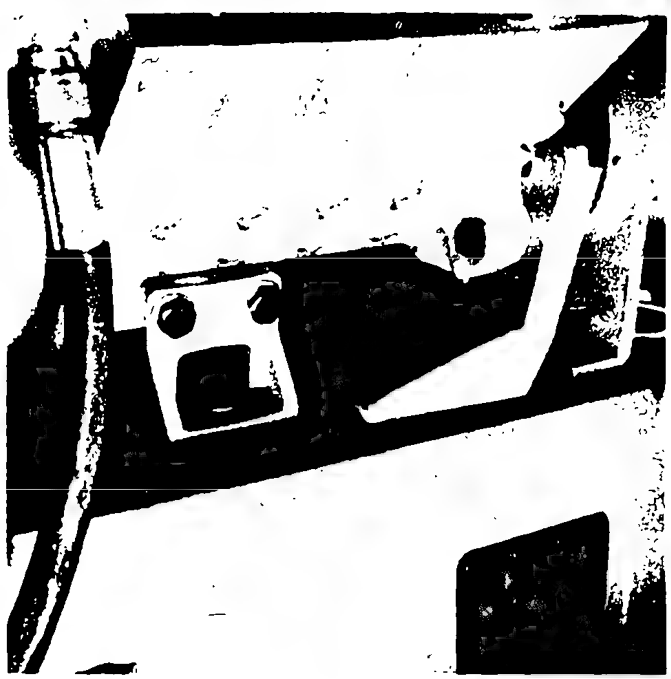


2

Special Features:

We again point out the use, as specified, of the adjustable multi-plate couplings - fitted as standard on the new test bench series EFEP 375.., 385, 390 and 410. An essential prerequisite for trouble-free running of the coupling and injection pump is coupling with the coupling fingers in horizontal position (compensate for any possible play present) and careful tightening of the hex. socket-head screw. Do not forget the guard!

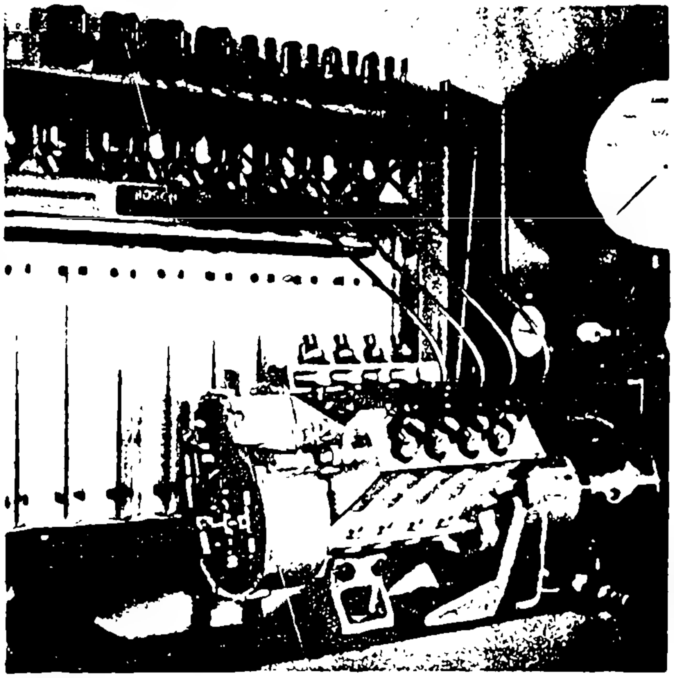
Note: The coupling must not run without load. Accident risk! Always clamp pump in position or remove coupling as the case may be; for example, when checking the revolution counter.



3

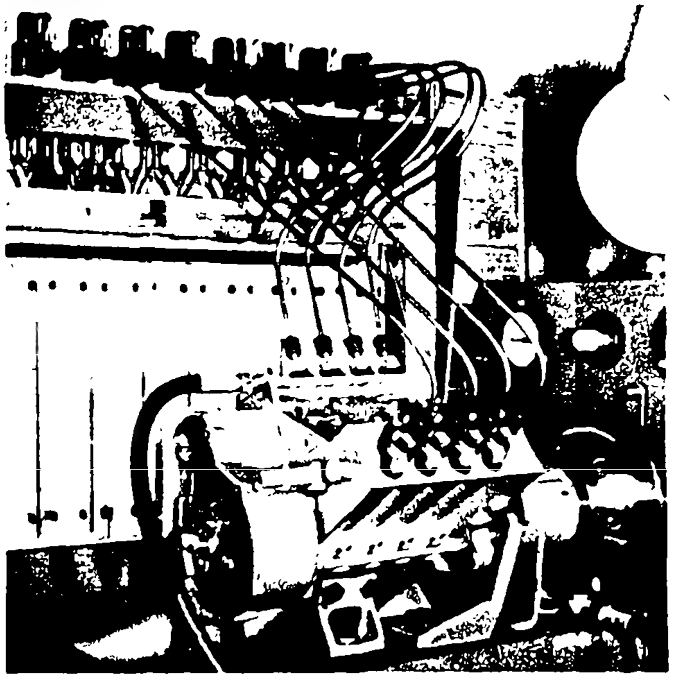
Clamping PESV..P pumps to the test bench requires a special clamping bracket and, on account of pump size, an additional support block.

L8



On account of the inclined governor position a supplementary item for the setting device (0 681 440 006 - EFEP 56 C) was pr[illegible]d which has the designation (1 688 04[illegible] EFEP 56 C/4) (see Fig. 13).

4 The delivery lines must be correct[illegible]r to commencement of testing and m[illegible]ed accordingly. It is advisable to fit the lines for the L.H. row (front row - cylinders 5 to 8) first.



5 Then, bend and connect the lines for the R.H. row (rear row - cylinders 1 to 4) (Fig. 4 and 5 - see also VDT-WJP 115/1B, Fig. 18).

Lubrication

When fitted to the engine, these pumps generally run with engine lubrication. When the pumps are fitted to an engine, they must therefore be given an initial lube oil filling.

6 Adequate lubrication must likewise be provided on the test bench. If necessary - for basic settings - fit a suitably sawn-off governor cover so that above all, the tappet guides, tappet rollers, cam tracks and ball bearings will be adequately lubricated. The supply pump should be removed and the feed pump actuator rod raised and held out of action (see Fig. 6). Fill in lube oil through the holes for governor springs, supply pump and control rack relay leve[illegible] Seal off oil return on bearing cover.

L9

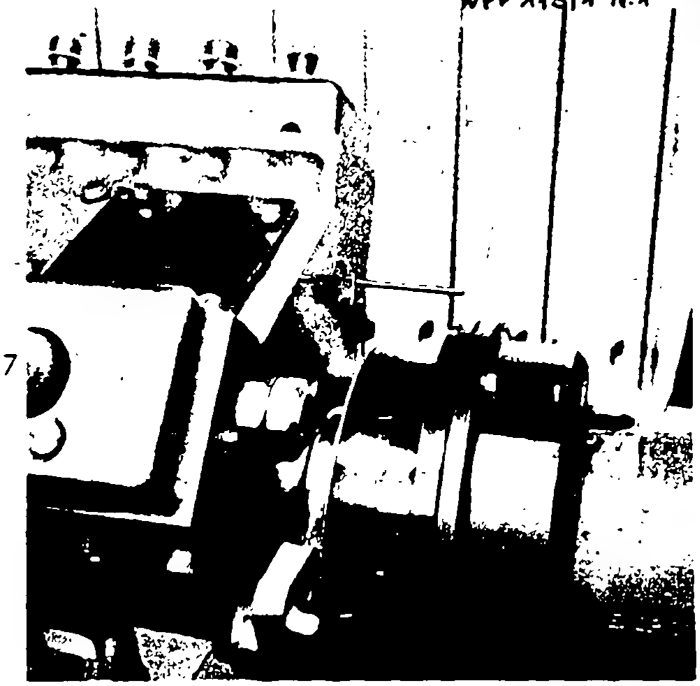
Injection timer

On pumps with associated injection timer (according to the assembly number), the pump should be tested with the injection timer. It must, however, be ensured that the injection timer works without play nor restraints, as otherwise measurements will be influenced unfavourably.

When carrying out tests, therefore, check injection timer first.

For new settings, check injection timer after basic adjustment and governor check

7

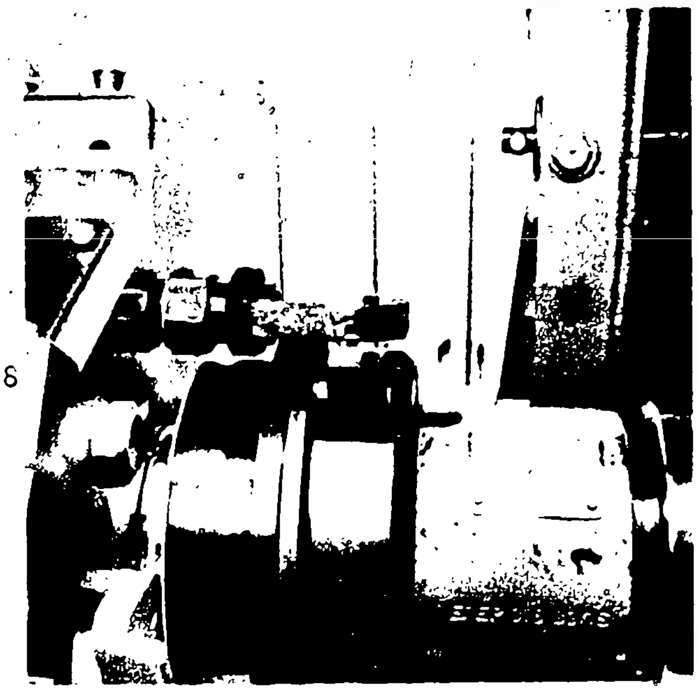


Fit control rack travel measuring device 1 688 130 030 EFEP 393:

Screw in stud,

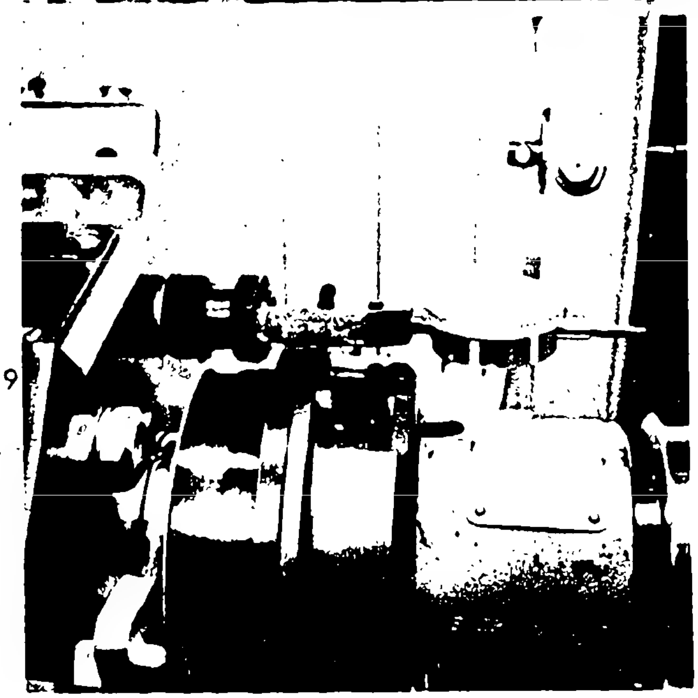
screw in clamping adaptor and holder simultaneously.

8



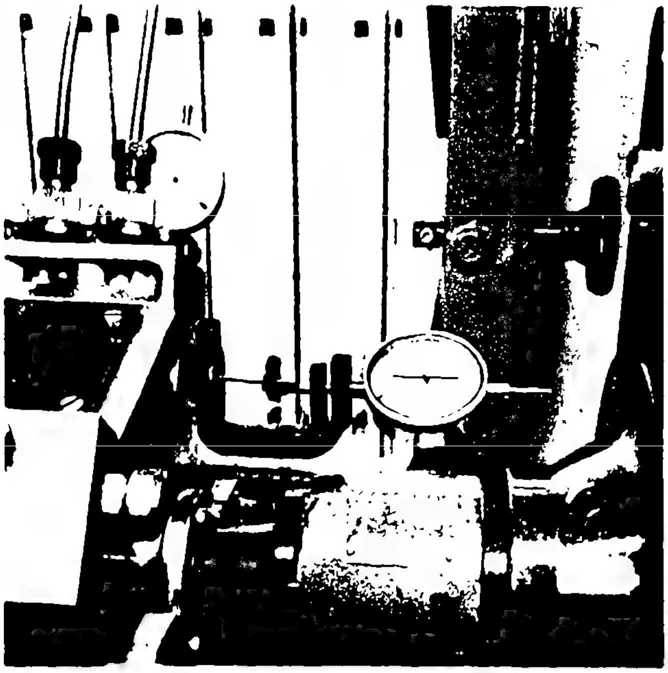
Fit dial indicator, couple to control rack. Set dial indicator to 0.

9



L10

3. PUMP-TESTING



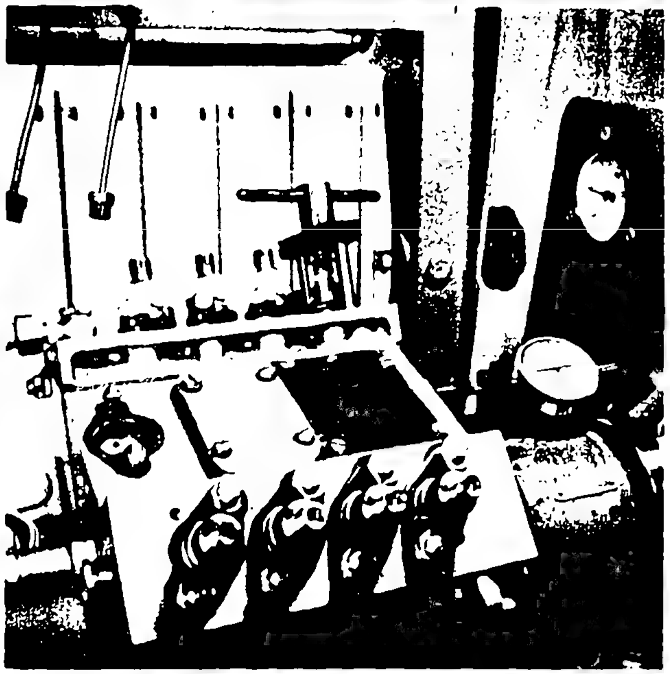
10

Setting commencement of delivery

Set "plunger lift to port closure" in accordance with the specifications sheet. Only connect to supply, the return line is to be closed off for this test.

Set plunger lift to port closure,

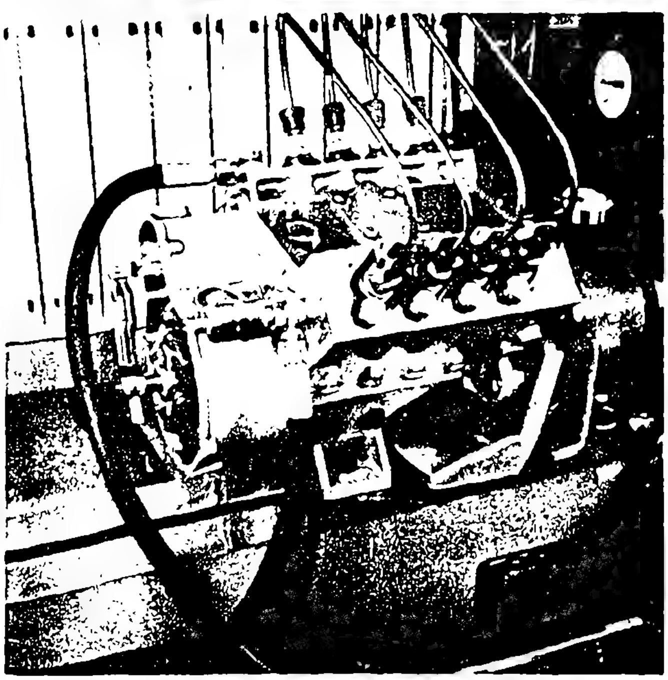
check commencement of delivery.



11

check cam phasing,

correct by placing shims under the flanged bushings.



12

Set delivery rate, Section A of the test specifications sheet. For delivery rate adjustment the return line must be connected via the overflow valve. Adjust supply pressure to 1.5 kp/cm^2 at the regulator valve.

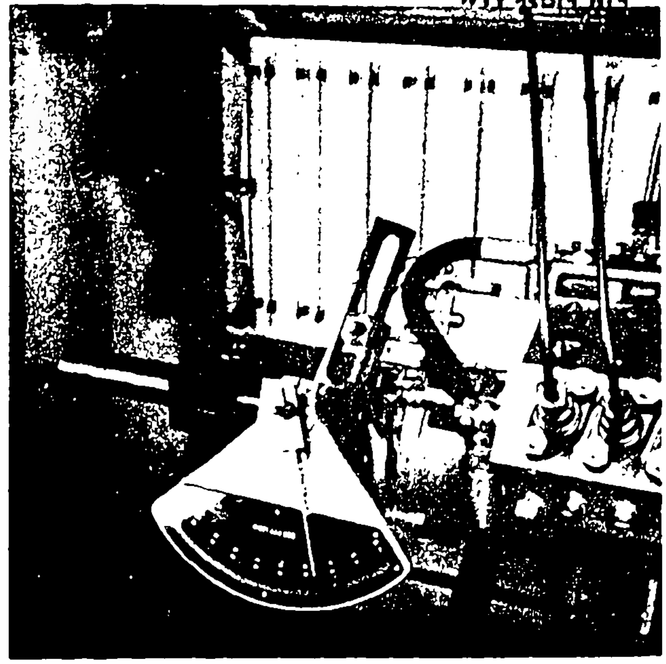
L11

4. GOVERNOR TESTING

Section B of the test specifications sheet - see VDT-WPP 001/4B.

When carrying out this test on RQ(U)V and EP/RS(U)V governors, the new clamping device (1 688 040 122 - EFEP 56 C/4) must be used to supplement the setting device (0 681 440 006 - EFEP 56 C). Accurate alignment relative to inclined angle position of governor is essential.

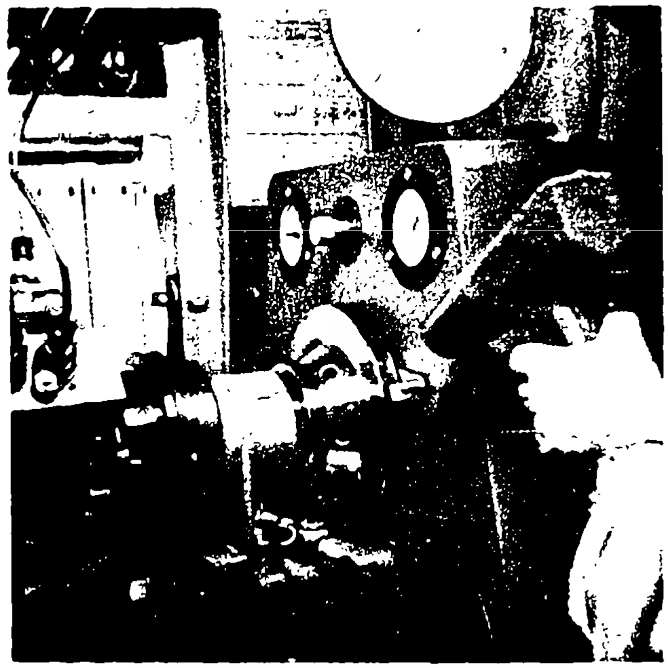
13



5. INJECTION TIMING CHECK

For checking the injection timer, see VDT-WPP 222/... When carrying out injection timing checks on complete pump units (with governor), the full load delivery rate should be provisionally limited to 100 cc at nominal governor speed. When required, scribe "commencement of delivery" on injection timer, see also Figs. 7 to 9.

14



6. FULL LOAD ADJUSTMENT

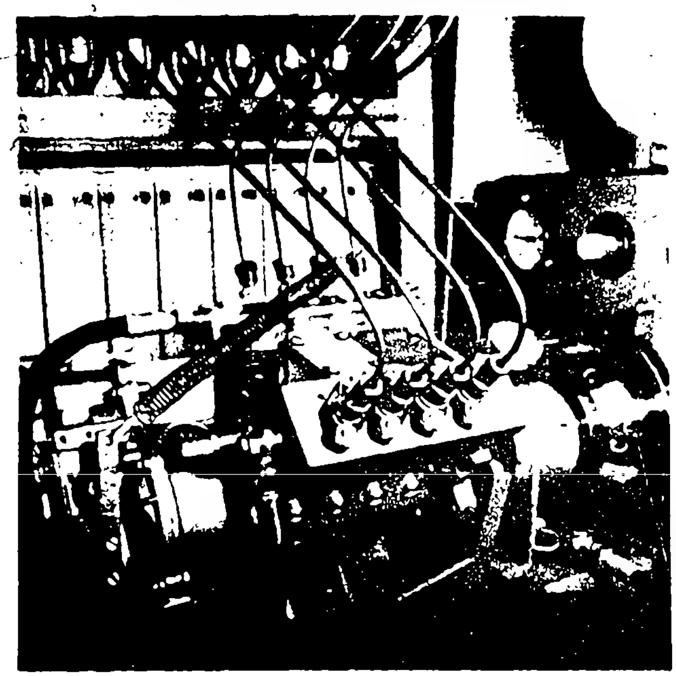
Section C of test specifications sheet -

Full load

Delivery rate characteristic

Starting quantity (Fig. 15).

15



7. FINAL OPERATIONS

Leakage test

Lock all stops and lead-seal.

L12

* ATM IH L12

BOSCH

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Diesel Fuel Injection Pumps PESV . . P . .

Control Rod Pivot

Since the introduction of PESV..P.. pumps, the pivot mechanism between the two control rods has been altered several times. Drawing 1 shows the latest pivot mechanism design.

In principle, all models are similar. They differ only in the way the pivot lever is hinged to the control rods. Assembly instructions in Repair Instructions VDT-WJP 115/1 B (Fig. 45) are still valid.

In the Test Instructions VDT-WPP 115/1 B, 1st Supplement, the following note, applicable to all models, should be added to the text accompanying Fig. 9:
Set the pivot lever flange within the slots so that both control rods move smoothly over their entire range of travel and so that the maximum control rod travel is approximately 21 mm/0.827 in.

In one of the intermediate models, the control rod pivot is fully cardanic (see Fig. 2).

In this model, lateral displacement of the pivot pin (pivot lever flange can also be shifted laterally across the slot width) causes a variation in total control rod travel and, consequently, uneven fuel delivery characteristics between the two banks.

For this special case, the following should be added to the text accompanying Fig. 12 in the 1st Supplement of the Test Instructions:
During calibration (basic adjustment), test to determine if a difference in delivered quantity exists between the two banks when tested at the minimum and maximum control rod travel (cf. Test Specification Sheet, Section A).

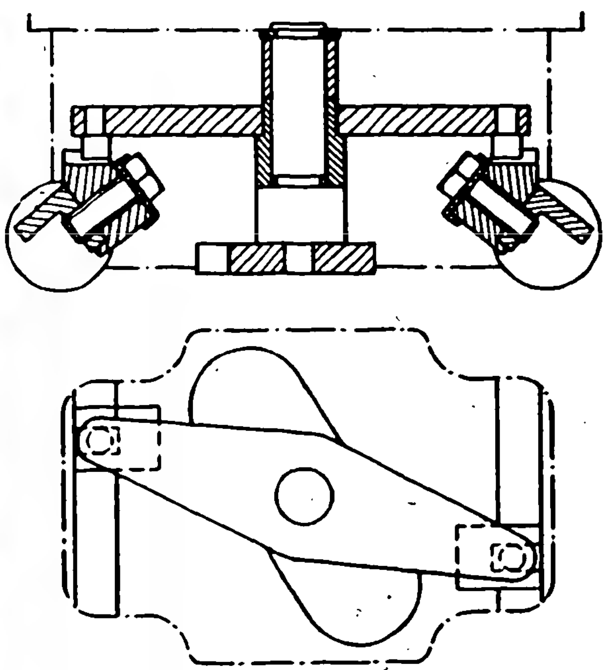
Example:

Minimum control rod travel	= no difference
Maximum control rod travel	= variation between the banks.

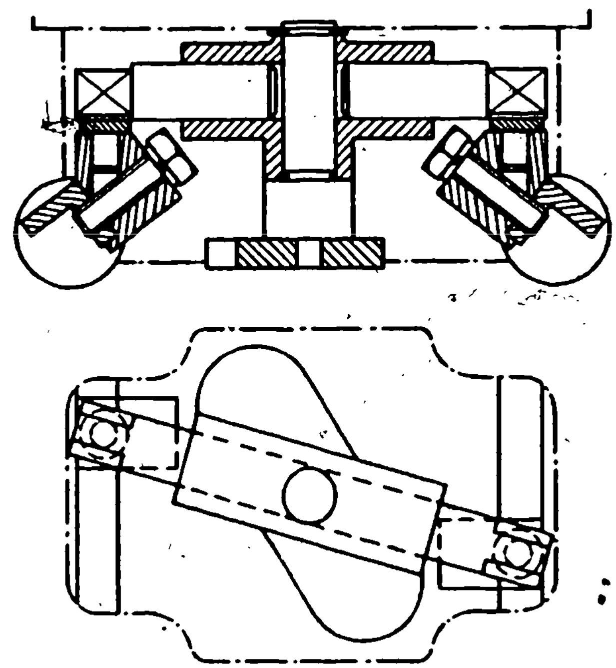
To adjust, loosen the fastening screws of the pivot lever flange and move it sideways toward the middle.

When performing this operation, always observe the note to Fig. 9.

Drawing 1



Drawing 2



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Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei

L13

SETTING OF PORT CLOSING

EP-combinations 0 402 848 ..
using the fuel-injection pumps

PESV 8 P 90/320 LS 5
.. LS 11 — Fitted in MAN engines of the model range
.. LS 11 Z — D 2858/M1, D 2658 M 2, D 2658 M 20,
.. LS 13 — D 2658 M 23 and D 2658 M 4

Up till now, the port closing adjustment on engines with an 8-cylinder, P-type pump (2 cylinder banks in "V" form) has led to leaks and maladjustment of the delivery quantity on pump-cylinder 1. This was due to the fact that the delivery-valve holder of pump cylinder 1 (seen looking from the pump drive, 1st cylinder on the right) had to be unscrewed and the flange bushing turned with it. This fault has been reported from workshops and from MAN operators.

If it is necessary, for any reason whatsoever, for one of the above-named pumps to be removed in your workshops or at a MAN operator, it is necessary for you to carry out the following jobs in order to ensure perfect timing of the pump to the engine:

1. Check the uniformity of fuel delivery at rated speed in accordance with the test specifications. Observe cyl. 1.
2. Connect the port-closing measuring device 1 688 130 085 - EFEP 388 A together with the appropriate dial indicator to pump cylinder 1.
3. Unscrew the upper screw plug 2 443 462 014 at the supply pump (30 mm A/F), and replace it with the modified screw plug with inner thread. This screw plug is comprised of the following parts:

2 442 462 023	Screw plug with inner thread
2 443 462 024	Plug screw for screw plug
2 916 710 607	Flat seal ring

   Now screw the holder 1 688 130 044 - EFEP 466 into the internal thread of the screw plug, use a seal ring. Depending upon the particular dial indicator, it may be necessary to lengthen the measuring stem. The important thing is that the stem is long enough, with the dial indicator fitted, to reach the base circle of the supply-pump camshaft with ease i.e. it must be possible to set the dial indicator to "0" as detailed under Para. 4 (refer to Fig.).

4. Turn the camshaft in the normal direction of rotation and, when the supply-pump camshaft is in the BDC position, set the dial indicator to "0".

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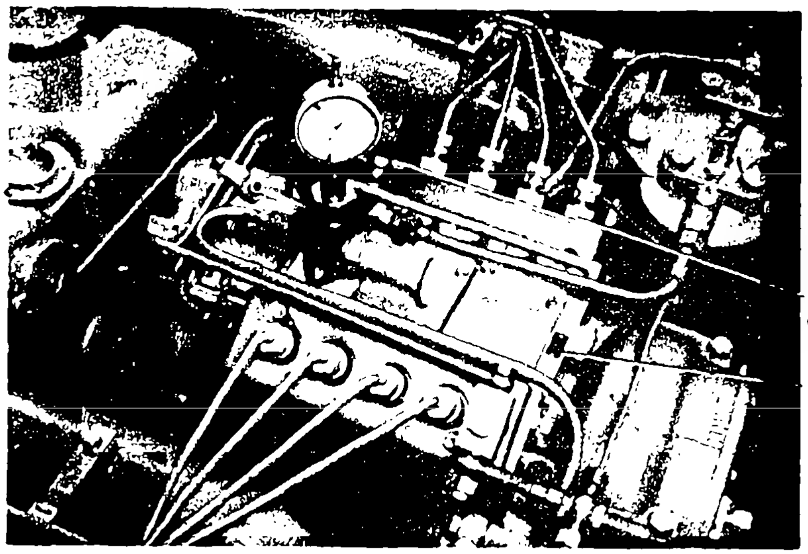
5. Check the plunger lift to port closing (refer to Test Specification Sheet). Here, at the position "start of delivery (FB), pump cylinder 1", the value read-off on the dial indicator mounted on the supply pump is to be stamped-in on a special plate in hundredths of a millimeter. This special plate, Part Number 1 901 102 005, is to be attached to the upper side of the pump housing (seen looking at the drive end) after the "Start of delivery (FB)" data has been stamped-in. It is to be fastened using 2 grooved drive studs (2 917 725 031), the numbers must be legible from the governor side (see Fig.).



Caution:

The pump is to be checked on the test bench as follows before the "start of delivery (FB)" data is stamped into the plate 1 901 102 005.

The work as detailed in Paras. 4 and 5 for determining the start of delivery, with the dial indicator on the supply pump, must be repeated a number of times with this pump type. The FB figure which has been determined must be reached again without any doubt in the following checks. Between each check, the pump must be run briefly at its rated speed ($n_p = 1000\,\mathrm{min}^{-1}$).

If the readings taken during these checks differ each time by more than 0.03mm compared to the previously taken measurement, this means that the roller of the roller tappet in the pump housing must be changed. This is carried out as follows:

- 0 Remove the fuel supply pump
- 0 Remove the governor cover, the flyweight assembly and the governor housing.
  Caution! Pay attention to the shims for camshaft play in the governor housing.
- 0 Unscrew the tappet-guide screw and pull out the supply-pump roller tappet 2 418 750 005.
- 0 Remove the tab washers 2 411 290 001 (for the roller) and replace the roller 2 410 202 009.

Reassembly is to take place in the reverse order.

After changing the roller in the roller tappet, the start of delivery figure must be determined again and stamped into the plate 1 901 102 005.

If for any reason at all, the supply pump is replaced, it is imperative that the start of delivery dimension is checked again. If it has changed, the new figure is to be stamped into the plate. If the supply pump is replaced in the vehicle, this check can be carried out using the port-closing setting device KDEP K 200, or the high-pressure hand pump 1 687 222 048.

Up till now, the out-of-round of the roller tappet has not been taken into consideration and the start of delivery has not been checked and marked on the pump. This means that a possibility must now be created in order to differentiate between the various pumps. The start of delivery figures which have been stamped into the plate as a result of this Technical Bulletin must therefore be clearly and legibly underlined.

The fuel-injection pumps concerned must be checked for correct setting in accordance with the Test Specification Sheet after the above checks have been completed.

6. In those cases in which the uniformity of delivery and the pre-stroke are both OK, i.e. with new pumps, the start of delivery dimension can be ascertained using the high-pressure hand pump EFEP 453 B - 1 687 222 048, or the port-closing setting device KDEP K 200, using the familiar high-pressure overflow method.
   Under no circumstances whatsoever are any of the delivery-valve holders to be loosened or unscrewed.

   The start of delivery dimension ascertained in this manner will be used in future as the reference point. For this reason, utmost care must be exercised when carrying out this step. If necessary, it is to be repeated.

This work is to be carried out free-of-charge for the customer, and is completely independent of warranty regulations which may have been applicable.

The warranty reporting and the warranty procedure for reimbursement for the work carried out, and material used, is to be as follows:

Outside Germany: The RG and AV are requested to credit 1 1/2h (15AW) on the collective warranty report for the work performed. This Technical Bulletin is to be quoted.

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PE(S)..P..A.. with suction-chamber pressure-damper "ROBO-Diaphragms"

In fuel-injection pumps of size P (formally also size B) in engines from the firms Scania and Volvo, so-called "ROBO-Diaphragms" are used partly as suction-chamber pressure-dampers.

These ROBO-Diaphragms are named in the appropriate test-specification sheets because different test steps have to be carried out with them.

The ROBO-Diaphragms can now be ordered like other Bosch service parts with part number

9 401 240 169 without ventilation holes
170 with ventilation holes.

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L17

FUEL-INJECTION PUMP 0 403 245..,
(PES 5 MW.. AND RW GOVERNOR)
Transverse shaking of engine in
lower idle range

In the Mercedes-Benz vehicles

300 D -Turbo, 300 TD-Turbo,
300 CD-Turbo, 300 SD-Turbo

there may be complaints due to transverse shaking of the engine in the lower idle range.

Corrective action:

The transverse shaking at idle speed, i.e. with the injection pump mounted, can be eliminated by engaging the damper (friction brake) in the RW governor (see Service Information VDT-I-MB 041).

Should the above-described action not eliminate the transverse shaking, a further improvement can be achieved by reducing the dispersion of fuel deliveries at idle. To do this, remove the fuel-injection pump.

On the injection-pump test bench, contrary to the value given in Section A of the test-specification sheet, set the equal delivery of the injection pump to $\leq$ 0.5 cm^3/1000 lifts.

This work is subject to payment and setting should be performed at the newly specified speed of $n = 365\ min^{-1}$.

The fuel delivery which is to be newly set at this speed is 10.0 - 11.0 cm^3/1000 lifts.

Subsequently, check the equal delivery at $n = 375\ min^{-1}$.

The fuel delivery must be 5.5 - 9.5 cm^3/1000 lifts, and the dispersion (difference between fuel deliveries) must not exceed 1.0 cm^3/1000 lifts (see new test-specification sheet, Section C).

Since this low dispersion value can only be set with correctly functioning test equipment, the test equipment (lines, calibrating nozzle-holder assembly, coupling play) must be checked beforehand if necessary.

Setting the equal delivery at 365 min^{-1} leads in the above-mentioned injection pumps to a higher setting accuracy and has a positive effect on the idle behaviour of the engine.

Therefore, as of FD 442 (February 1984) the equal delivery of these injection pumps is set at the factory at 365 min^{-1}. The test specifications have been changed accordingly.

Note:

When repairing the injection pump, do not bring the adjusting screw up against the driver since transverse shaking of the engine does not occur in all vehicles. However, always tighten the lock nut to 20 - 25 Nm.

Responsible:

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VDT-I-403/1000 En
1.1986

NEW CALIBRATING FUEL-INJECTION TUBING FOR MW PUMPS

For testing the MW-pumps with delivery-valve holders M 14x1.5 (installed at DB and IHC) it is necessary to use a calibrating fuel-injection tubing with M 14x1.5 connection thread at both ends.

The use of calibrating fuel-injection tubing 1 680 750 015 with M 14x1.5 connection thread likewise at both ends cannot be permitted due to shifts in fuel delivery.

Technical data

Calibrating fuel-injection tubing 6 x 2 x 600 mm (O.D. x wall thickness x length).
Connection thread at both ends M14x1.5.
Part number: 1 680 750 008.

Note:
The calibrating fuel-injection tubing is specially mentioned on the test-specification sheets for the in-line pumps concerned.

The tubing is available ex KH/ALP warehouse.

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1 Technical Bulletin

BOSCH

TEST INSTRUCTIONS

41

VDT-WPP 116/1 B

<VDT-W-413/301 B>

Ed. 1

Fuel Injection Pumps

0 413 . . - PE (S) . . MW . .

L21

Contents

1. Introduction

This booklet describes the adjusting and testing of Fuel Injection Pump (PE(S) . . MW. . .

The sequence of illustrations and accompanying text given here represents the most effective sequence of the individual steps.

The construction and operation of this fuel injection pump are described in Technische Mitteilung VDT-BEP 102/1 B < VDT-I-403/1 B >.

Special testing equipment and tools required for testing and adjusting this fuel injection pump are listed in Section 2.

Use Calibrating Oil 61 v 11 or Shell Calibration Fluid B with a temperature of 40 + 5°.

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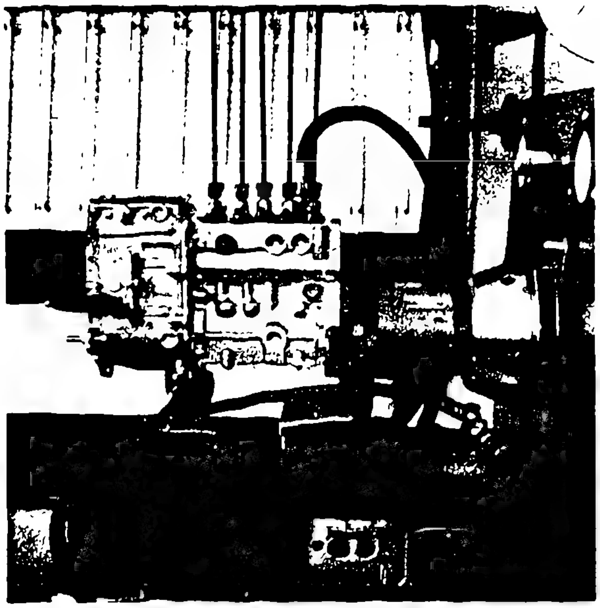
2. Testing Equipment and Tools Required

Testing Equipment Tool	Part Number Type	Use
Testing equipment	see VDT-WPP 110/2 B (such as PES . . M . .)	
1 Clamping bracket	1 688 010 010 EFEP 157 1 688 010 011 EFEP 157 A	For test bench with shaft height 125 mm Shaft height 110 mm
1 Flange with ring	1 685 720 018 EFEP 157/6 1 685 720 017 EFEP 157/4 1 680 202 005 EFEP 29/0/3	PES . . with 3-hole flange PES . . with 4-hole flange Internal diameter 68 mm
1 Mounting device	1 688 030 111	PE with cradle mounting
1 Setting device	0 681 440 006 EFEP 56 C	
1 Plunger lift to port closing measuring device	1 688 130 136	
1 Control-rod travel measuring device	1 688 130 134	
1 Dial indicator, measurement range 30 mm, graduations 1/100 mm; if not available, dial indicator, measurement range 10 mm, graduations 1/100 mm, with measurement insert 14 mm long	1 687 233 012 EFAW 63 1 687 233 011 EFAW 7	For plunger lift to port closing measuring device
1 Dial indicator, measurement range 30 mm, graduations 1/10 mm (without return spring)	1 687 233 015 EFAW 144	for control-rod travel measuring device



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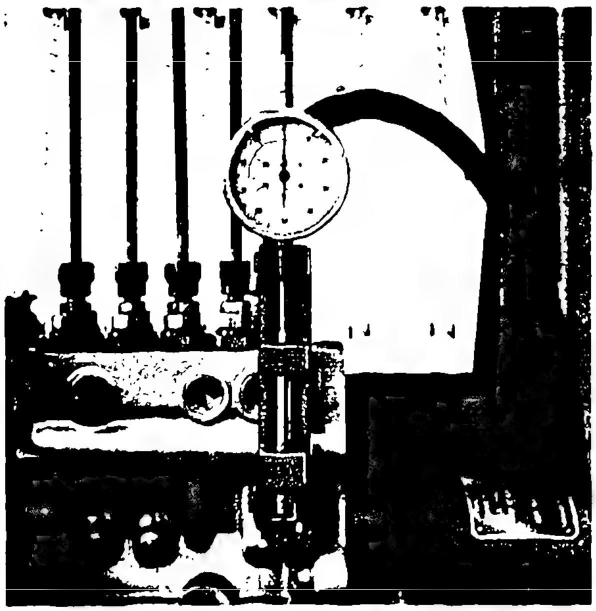

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3. Clamp the Fuel Injection Pump in Place

Clamp the fuel injection pump together with the governor onto the test bench using the proper clamping bracket, flange, or mounting device (see Section 2).

Remove the rear governor cover.

Connect the nozzle holder assemblies and the fuel injection tubing (see Section 2), applying counterpressure to the valve holders as this is done.

Unscrew the supply pump and fill the camshaft chamber with HD engine oil.

Quantity of oil required:
PE(S) 2 . . to PE(S) 5 . . : 0.25 l,
PE(S) 6 . . to PE(S) 12 . . : 0.50 l.

Then close the supply pump hole with a cover (for example 1 900 508 024).

4. Test Port Closing and Adjust Plunger Lift to Port Closing

The **plunger lift to port closing** is the distance in mm from the bottom dead center position of the piston to port closing.

Connect the feed hose at the suction gallery of the injection pump.
Close the return flow hole with the proper screw plug (with shoulder and hexagon socket) and seal ring.

Attach the plunger lift to port closing measuring device without the seal ring in the bottom dead center position of the tappet at outlet 1. When doing this be sure that the measuring device sensor rests against the roller tappet.

Set the dial indicator to "0" in the bottom dead center position of the roller tappet.

Mount Setting Device EFEP 56 C on the test bench and align it.
Set the control rod with the control lever to max. control-rod travel and fix it in this position with the setting device.

In special cases the control rod position is given in the test specification sheet (mount the dial indicator as described in Section 5).

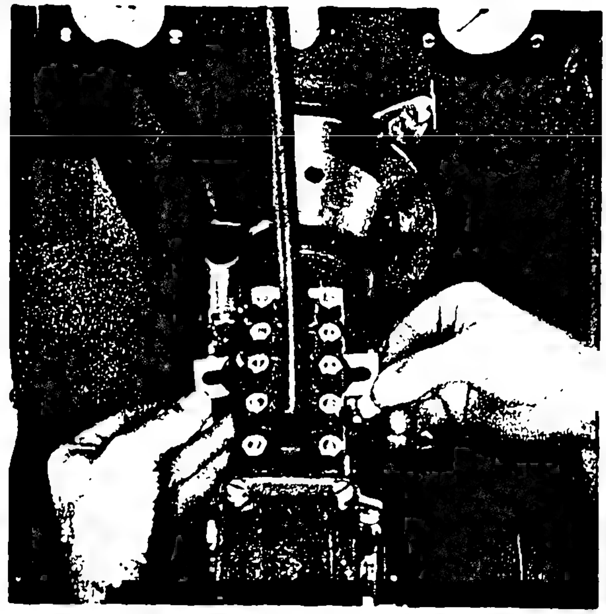
With the bleeder screw open at the calibrating nozzle holder assembly attached to outlet 1, increase the **feed pressure** until calibrating oil comes out of the overflow tube with no bubbles.
Turn the camshaft slowly in the direction of rotation until port closing is reached.
Port closing is reached when the flow of calibrating oil from the overflow tube at the nozzle holder assembly is changed to drops.
Read the dial indicator and compare this reading with the value given as "Port closing at plunger lift to port closing" in the test specification sheet. When checking the fuel injection pump, the value given in parentheses can be increased by the tolerance given in the test specification sheet.

Compensation is made for deviations from the nominal measurement by inserting the proper adjusting plates (available in thickness steps of 0.05 mm) between the barrel and valve assembly and the pump housing.

Caution:
Adjusting plates of the **same** thickness (same identifying number) must be used on both sides of the barrel and valve assembly, and only **one** plate should be inserted on each side!

At the specified plunger lift to port closing of outlet 1, set the needle on the graduated disc on the test bench to a number of degrees favorable for the reading. Close the bleeder screw at the nozzle holder assembly.

Remove the plunger lift to port closing measuring device and seal the threaded hole with a new seal ring. Port closing of the other plunger and barrel assemblies is set according to the number of degrees of angular cam spacing, starting from the tested or adjusted first cylinder.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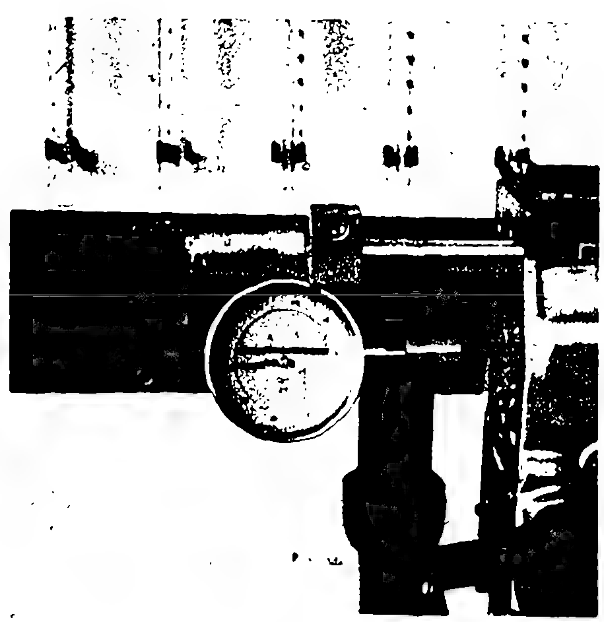
Normal cam sequence:
with 4 cylinders: 1-3-4-2,
with 6 cylinders: 1-5-3-6-2-4.

The angular cam spacing = 360° divided by the number of cylinders (for example, with the PE(S) 6 . ., 360°/6 = 60°). Permissible adjustment tolerance: ± 0.5°.

Abnormal angular cam spacings are given in the test specification sheet.

5. Test and Adjust Fuel Delivery

Mount the control-rod travel measuring device onto the governor housing. Screw the threaded bolt together with magnet into the control rod.
Press the control rod to the end limit stop and set the dial indicator to "0".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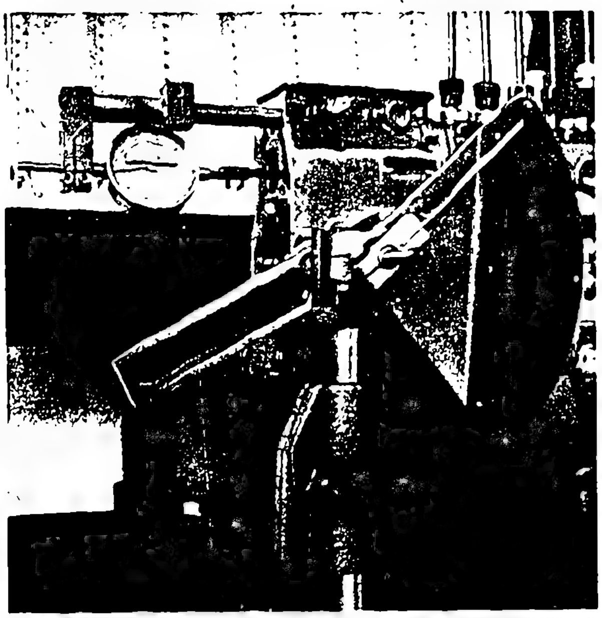


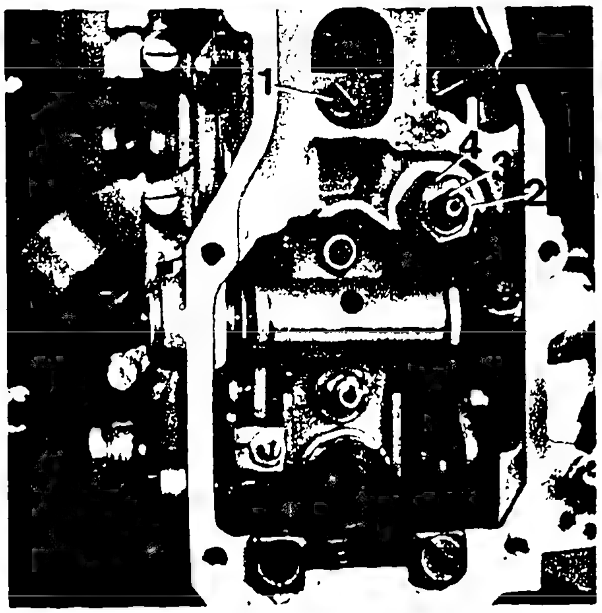
5

If support threads (M8) are provided on the governor housing, a homemade support bracket with spacer piece (see Section 6) must be mounted between the injection pump and the test bench.

We recommend that a governor cover that has been cut off, together with a gasket, be mounted in order to prevent the oil from flowing out.

Close the overflow valve at the suction gallery return flow hole.

Set the suction gallery pressure of 1 bar (with flushing).



6

RW Governor

Pretension the governor spring completely by turning the adjusting screw (1) all the way in. Also turn the adjusting screw (2) for the follower lever all the way in; for this purpose release the hexagon nuts (3, 4).

Then tighten the hexagon nuts (3, 4).

Drive the fuel injection pump at the speed given in the box in Section "A" in the test specification sheet; set the specified control-rod travel using the control lever, and fix it in this position.

RWV Governor

Pretension the governor spring completely by turning the adjusting screw (1) all the way in.

Set the control lever completely to the full-load nominal speed. Release hexagon nuts 3 and 4.

Drive the fuel injection pump at the speed given in the box in Section "A" of the test specification sheet and set the specified control-rod travel with adjusting screw 2.

Then tighten hexagon nuts 3 and 4.

RW and RWV Governors

Check the quantity of fuel sprayed.

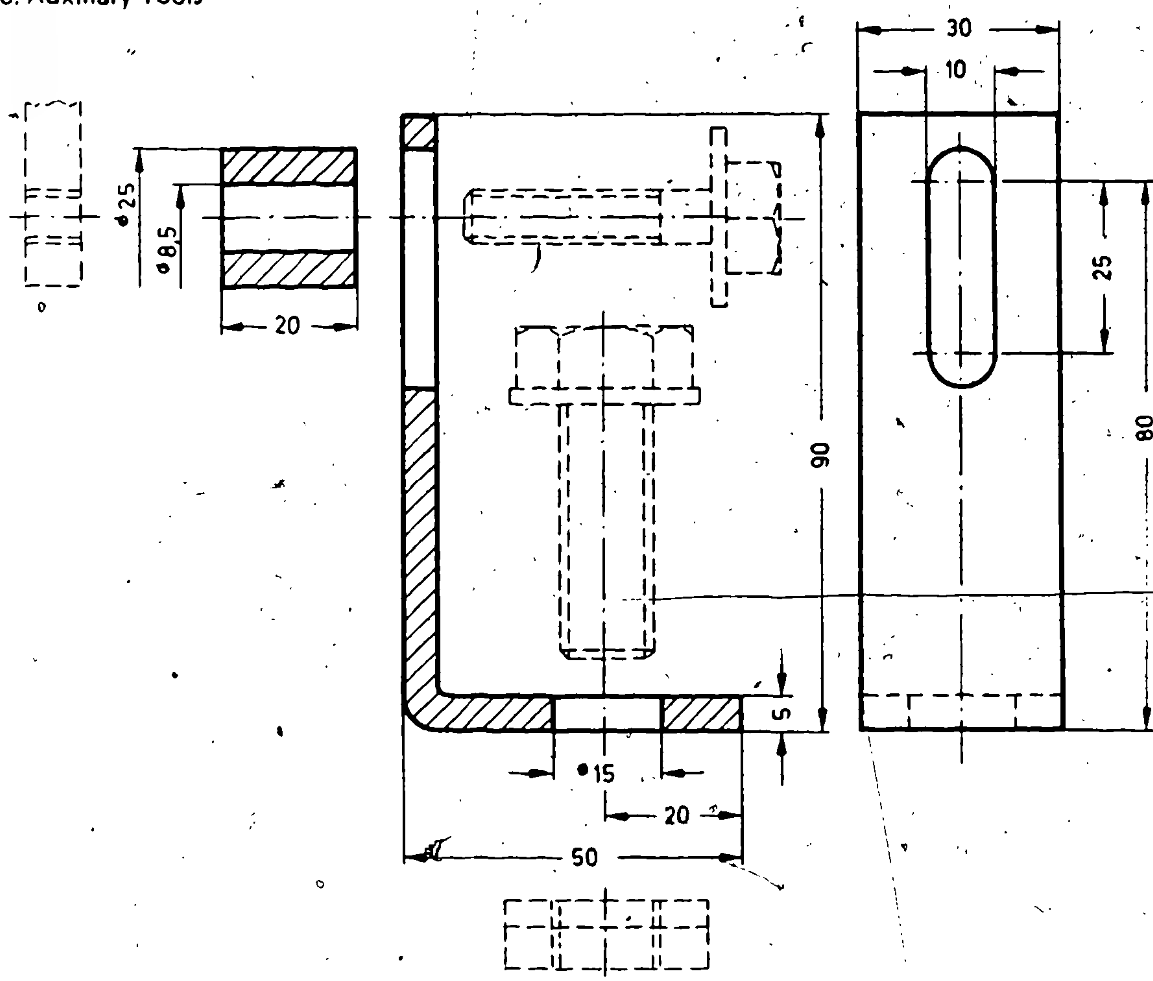
The basic fuel delivery setting applies as a pre-setting (100-stroke measurement) and is adjusted by turning the barrel and valve assembly. For this purpose, release the fuel injection tubing (apply counterpressure to the delivery valve holder when doing this) and the hexagon nuts at the barrel and valve assembly.

Retighten the hexagon nuts at the barrel and valve assembly as well as the retaining nut at the fuel injection tubing. For tightening torques see VDT-WJP 116/1 B or VDT-WJP 101/2 B.

The permissible difference in fuel delivery given in column 4 of the test specification sheet applies for the plunger and barrel assemblies of one fuel injection pump. The fuel delivery given in column 3 is the average value for all plunger and barrel assemblies.

The governor, full-load delivery, and the final value of the fuel delivery difference are adjusted according to Test Instructions VDT-WPP . . ./. . as well as Sections "B" and "C" of the test specification sheet.

6. Auxiliary Tools



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After-sales Service Instructions

Testing

41

VDT-W-413/301 En
Suppl. 1
Ed. 1

Fuel-Injection Pumps

PE (S) . . MW . . S 1000 . . and S 1500 . .
with 10-mm Plunger Lift

BOSCH After-sales Service
Automotive
Equipment

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Contents

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(3.78)

M1

M1

W-413/301
Suppl. 1

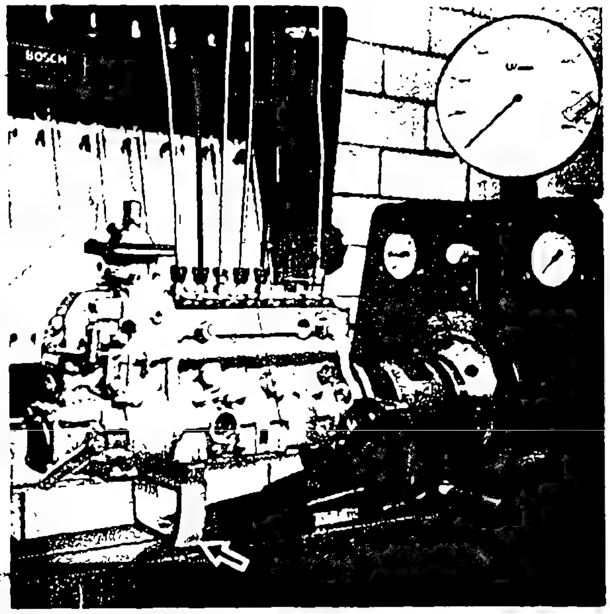
1. Introduction

This supplement to Test Instructions VDT-W-413/301 B refers to the testing and adjustment of Fuel-Injection Pumps PE(S)..MW..S 1000.. and S 1500.. with 10-mm plunger lift.

Some special tools are required for this testing and adjustment work, and are listed in Section 2 below.

2. Special Tools Required

Test Equipment Tool	Part Number, Type Designation	Use
Test equipment	see VDT-WPP 110/2 B	PES..M..
1 Clamping bracket	1 688 010 010 EFEP 157	For test bench with shaft height 125 mm
	1 688 010 011 EFEP 157 A	Shaft height 110 mm
1 Flange	1 685 720 017 EFEP 157/4	PES..MW..S 1000.. with 4-hole flange
with ring	1 680 202 005 EFEP 29/0/5	Pilot diameter 85 mm
1 Flange	1 685 720 060 EFEP 157/7	PES..MW..S 1500.. with large 4-hole flange (pilot diameter 95 mm)
2 Mounting devices	1 688 030 111	Fuel-injection pumps with cradle mounting
1 Plunger lift to port closing measurement device	1 688 130 135	To measure the plunger lift to port closing
with sleeve	1 683 350 066	
and driving pin	1 682 012 008	
1 Control-rod travel measuring device[1]	1 688 130 030 or 1 688 130 130	To measure and adjust the control-rod travel
tube fitting	1 683 350 064	
tube fitting	1 683 350 065	
driving pin	1 683 201 013	
1 Dial indicator, measurement range 30 mm, graduations 1/100 mm	1 687 233 012 EFAW 63	For plunger lift to port closing measurement device
1 Dial indicator, measurement range 30 mm, graduations 1/10 mm (without return spring)	1 687 233 015 EFAW 144	For control-rod travel measuring device
1 Setting device	0 681 440 006 EFEP 56 C	
1 Support piece	1 688 030 122	For fuel-injection pumps with end-flange mounting



1

3. Test the Fuel-Injection Pump

3.1 Clamp the Fuel-Injection Pump in Place

Clamp in the fuel-injection pump together with the governor to the proper clamping bracket or mounting device (Section 2). For this purpose, the clamping flange must be modified (Section 4, Figs. 5 and 6).

Connect the nozzle-holder assemblies and fuel-injection tubing, applying counterpressure to the valve holders as this is done.

PES fuel-injection pumps must be supported by the support piece (arrow).

Unscrew the supply pump and fill the camshaft chamber with HD engine oil.

Quantity of oil required:

PE(S) 2.. to PE(S) 5.. = 0.25 l
PE(S) 6.. to PE(S) 12.. = 0.7 l

Then close the supply-pump hole with a plastic cover (for example, 1 900 508 024).

Remove the governor cover and mount the protective cover (to be made b .. user, see VDT-WPP 001/4 B, Suppl. 6).

3.2 Test Port Closing and Adjust Plunger Lift to Port Closing

The **plunger lift to port closing** is the distance in mm from the bottom dead center position of the plunger to port closing.

Connect the feed hose at the suction gallery of the injection pump.

Close the return flow hole with the proper screw plug (with shoulder and hexagon socket) and seal ring.

Attach the plunger lift to port closing measuring device **without** the seal ring in the bottom dead center position of the tappet at outlet 1 (or at the last outlet on the governor side). When doing this be sure that the measuring-device sensor pin rests against the roller tappet. Set the dial indicator to "0" in the bottom dead center position of the roller tappet.

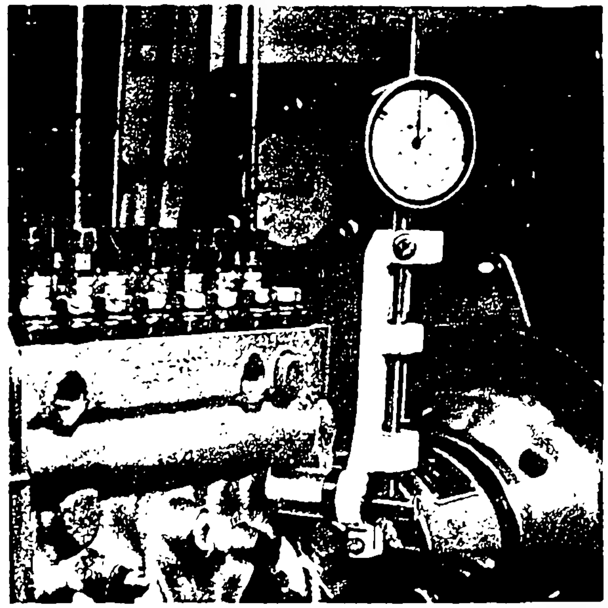
Mount the control-rod travel measuring device on the drive side of the pump housing. In order to do this, proceed in the following manner:

Remove the screw plug, and screw the headless screw (M3) into the control rod. Screw the clamping sleeve into the housing, and mount the dial-indicator holder. Place the dial indicator in the holder, and screw the coupling section into the measuring base of the dial indicator. With the control rod in the STOP position, set the dial indicator to "zero" and clamp the coupling piece onto the headless screw. Be sure that the control rod can move from one end position to the other (travel of about 21 mm) (Fig. 3). Set the control-rod travel specified.

With the bleeder screw open at the calibrating nozzle-holder assembly attached to the corresponding outlet, increase the **feed pressure** until calibrating oil comes out of the overflow tube without bubbles.

Turn the camshaft slowly in the direction of rotation until port closing is reached.

Port closing is reached when the continuous flow of calibrating oil from the overflow tube at the nozzle-holder assembly changes to drops.



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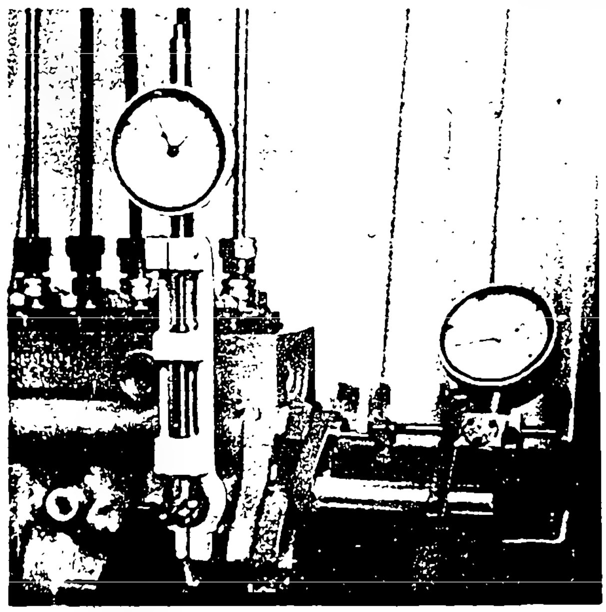

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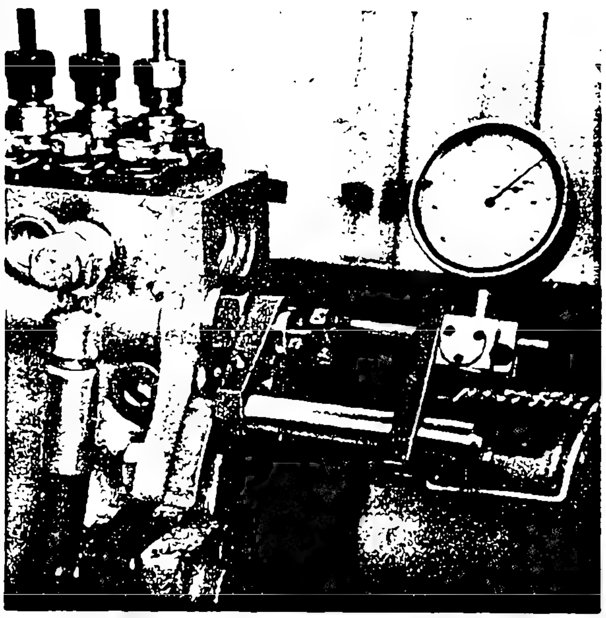
Read the dial indicator and compare this reading with the value given as "Port closing at plunger lift to port closing" in the test-specification sheet. When checking the fuel-injection pump, the value given in parentheses can be expanded by the tolerance given in the test-specification sheet.

Compensation is made for deviations from the nominal measurement by inserting the proper adjusting plates (available in thickness steps of 0.05 mm) between the barrel-and-valve assembly and the pump housing.

Caution:
Adjusting plates of the same thickness (same identifying number) must be used on both sides of the barrel-and-valve assembly, and only one plate should be inserted on each side!

At the specified plunger lift to port closing of outlet 1, set the needle on the graduated disc on the test bench to a number of degrees favorable for the reading. Close the bleeder screw at the nozzle-holder assembly.



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Remove the plunger-lift to port closing measuring device and seal the threaded hole with a new seal ring. Port closing of the other plunger-and-barrel assemblies is set in the same way at the proper number of degrees of angular cam spacing, starting from the tested and/or adjusted first cylinder.

The angular cam spacing = 360° divided by the number of cylinders (for example, with the PE(S) 6..., 360°/6 = 60°). Permissible adjustment tolerance: ± 0.5°

Abnormal angular cam spacings are given in the test-specification sheet.

Connect the overflow valve to the return flow hole at the suction gallery.

Set the suction gallery pressure to 1.5 bar.

Drive the fuel-injection pump at the speed given in the box in Section "A" in the test-specification sheet. Adjust the control-rod travel to the specified value using the control-rod travel measuring device, and fix it in this position. Check the amount of fuel injected.

The basic fuel-delivery setting applies as a pre-setting (100-stroke measurement) and is adjusted by turning the barrel-and-valve assembly.

For this purpose release the fuel-injection tubing (apply counterpressure to the delivery-valve holder when doing this) and the hexagon nuts at the barrel-and-valve assembly.

Retighten the hexagon nuts at the barrel-and-valve assembly as well as the union nut at the fuel-injection tubing.

Tightening torques:

	Nm	kgfm
Hexagon nuts:	20–25	2–2.5

The permissible difference in fuel delivery given in column 4 of the test-specification sheet applies for the plunger-and-barrel assemblies of **one** fuel-injection pump.

The fuel delivery given in column 3 is the average value for **all** plunger-and-barrel assemblies of one pump.

The governor, full-load delivery, and the final value of the fuel delivery difference are adjusted according to the corresponding test instructions [RQ (V); EP/RS (V)] as well as Sections "B" and "C" of the test-specification sheet.

4. Auxiliary Tools

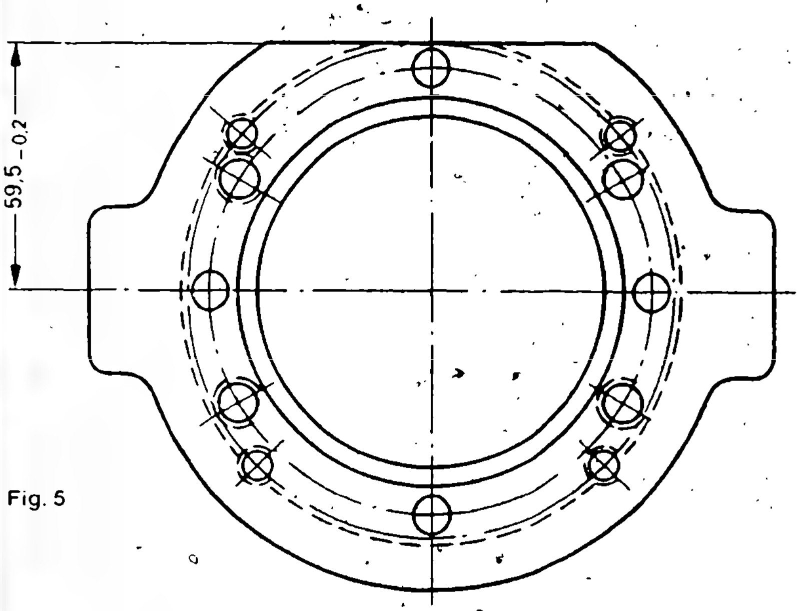

Fig. 5

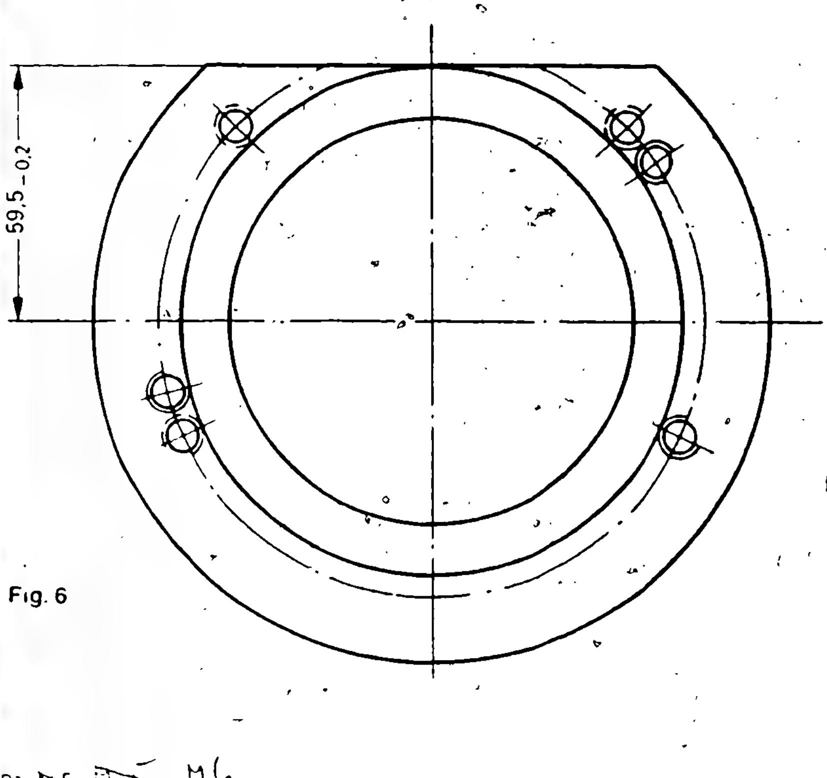

Fig. 6

M6

After-sales Service Instructions

Testing

41

VDT-W-413/301 En
Suppl. 2
Ed. 1

Fuel-injection pumps

PE (S) .. MW ..
and RW .. governors
with port-closing sensor system (FBG)

BOSCH After-sales Service
Automotive
Equipment

M7

This publication has been redesigned with the forthcoming change-over to microfilm in mind. When a publication has been transferred to microfilm. the screen will be filled completely by a quarter of a printed-publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference is constantly being made to a particular illustration.
Until the change-over to microfilm, we have slightly reduced the size of the print and of the illustrations.

Contents | Coordinates

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M8

1. Introduction

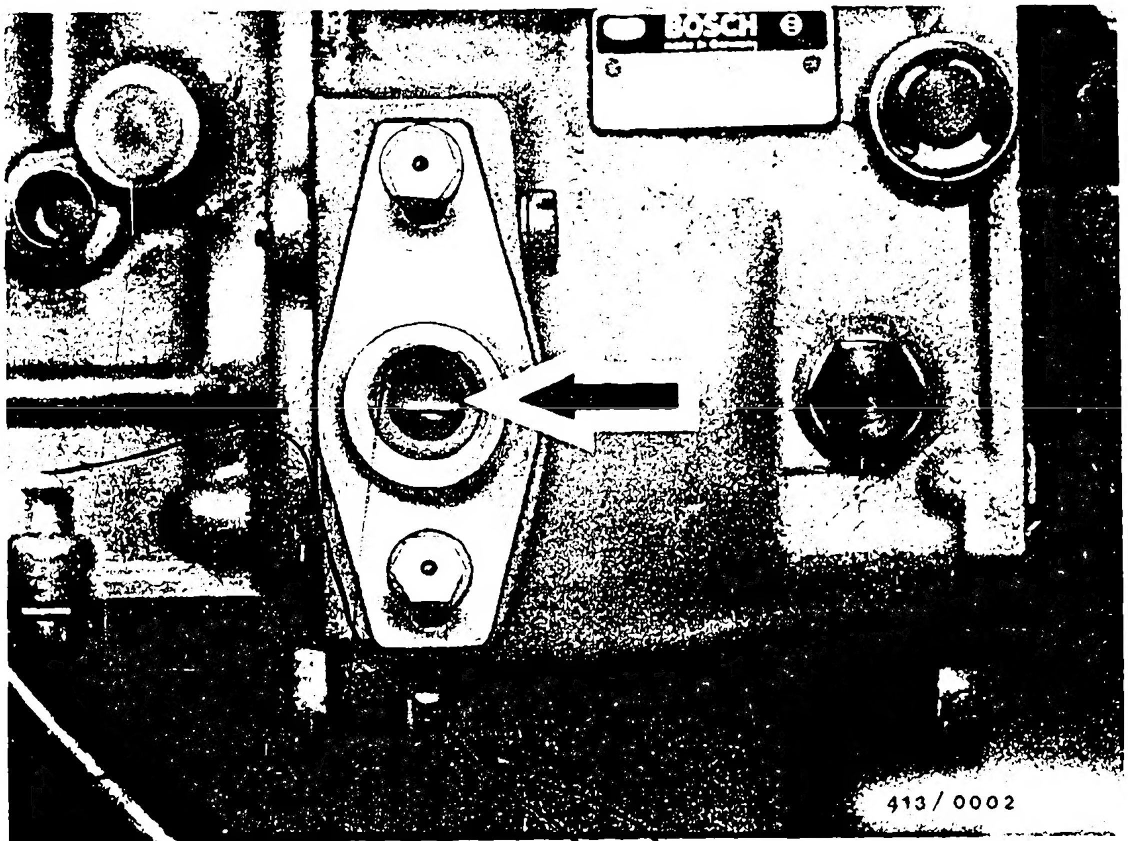
This supplement to Testing Instructions VDT-W-413/301 refers to the testing and adjusting of fuel-injection pumps PE(S) .. MW .. with port-closing sensor system.

The construction and operation of these fuel-injection pumps is described in Motor Vehicle Service Information VDT-I-413/1 (4.83).

2. Testing port-closing and setting prestroke

Test fuel-injection pump PE(S) .. MW .. in accordance with Testing Instructions VDT-W-413/301 - Ed. 1 - up to and including page 5, Section 3 ("... close bleeder screw of nozzle-holder assembly").

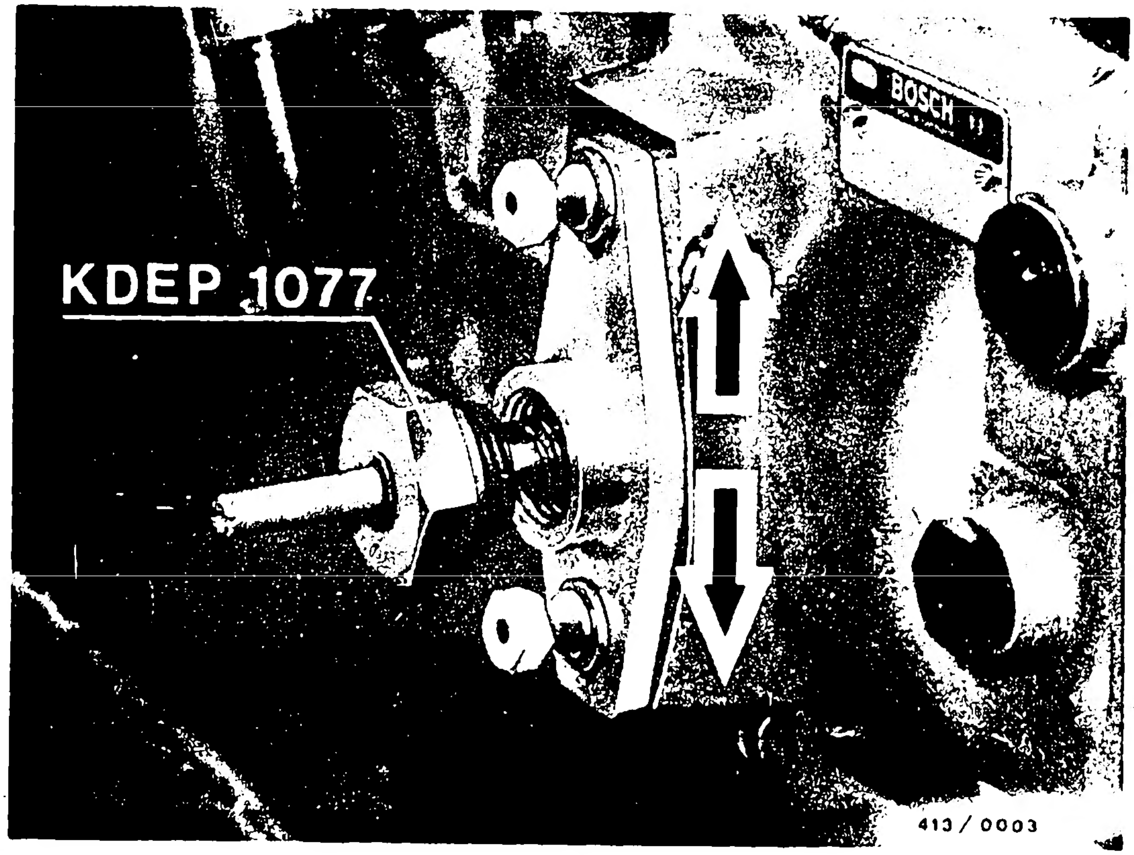
M 10



2.1 Different operations for governors with FBG system

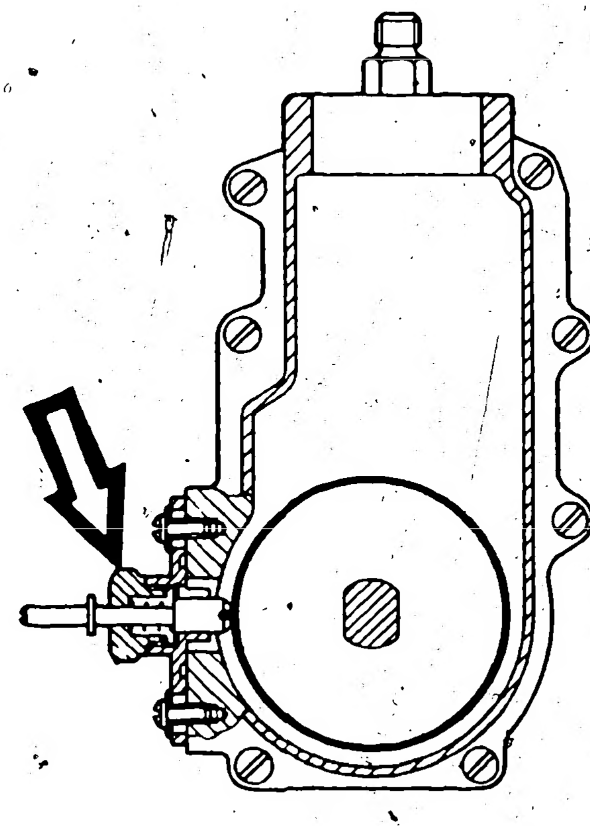
Turn the camshaft a further 19.5° in its direction of rotation.

In this position the lug on the flyweight must be visible in the tapped hole (arrow) of the sliding flange.



Insert the blocking device KDEP 1077 into the sliding flange.

Move the sliding flange in the region of the slots until the slit of the blocking device engages the lug of the flyweight part and blocks it.



413/0004

Screw the union nut of the blocking device (arrow) into the port-closing sensor bore and tighten the sliding flange. Use new break-off screws and twist off the head of the screw when tightening.

Remove blocking device KDEP 1077.

Remove prestroke measuring device and seal tapped hole with screw plug and new seal ring.

For the further working steps, proceed in accordance with Testing Instructions VDT-W-413/301 - Ed. 1 - starting on page 5 "The port closing of the other elements ...".